M31.2 Opa Water Supply Scheme

M31.2.1 Observations for Water Treatment Plant

The Opa facility has been augmented over the years and currently consists of 4 river intakes (one for each self contained WTP). The original site contains Plant I, 8MLD commissioned in 1957 and Plant II, 12 MLD commissioned in 1967. Plant III, 52MLD commissioned in 1972 (later increased to 72 MLD by adding an extra filter bed) and Plant IV, 40 MLD commissioned in 2004 are both sited at Curti, approximately 2.0 km away.

Table M31.2.1 lists the summary of asset data for the WTP and Table M31.2.2 contains detailed asset data for the WTP. The plant schematic is shown on Figure M31.2.1.

Both compounds, Opa and Curti, are adequately gated, fenced and secured by 24 hour on-site security personnel. All plants are operated and maintained 24 hours a day, using a three shift system.

Except for the newest plant, flow measurement devices are not installed. Therefore, the amount of raw water supplied to the plants and the clean water fed to reservoirs was estimated based on pump design capacities and hours of operation.

The original compound has a process control laboratory for the 8 MLD and 12 MLD plants. These plants are manually controlled. Considering the respective ages of the plants, most of the equipment appears to be in good working order, except for the alum and lime mixers. These mixers appear to be in poor order or out of service. Both plants have good maintenance standards.

Disinfection is achieved using gas chlorination. The chlorination is delivered using one tonne cylinders. Maintenance, installation standards and operation practices for chlorine use are poor. There are no facilities for adequately detecting or containing gas leaks. Personal breathing apparatus is available in the laboratory but is not used or maintained. Records of chemical usage and treatment parameters are logged by the laboratory staff.

Records of pump running hours, load, filter backwashing and clear water reservoir levels are logged. However records of repairs and maintenance/breakdown problems are not logged. The high speed pump couplings/shafts are not guarded.

The 40 MLD plant has its own process control laboratory. Records of the chemical usage and treatment parameters are logged by the laboratory staff. "M/S Environ Control Associates Private Ltd – Surat" built, operated and maintained the plant for 18 months before handing it over to the PHE'. A basic operation and maintenance manual was provided to the PHE at this time outlining basic operating, maintenance and H&S instructions. On the job training was provided by the contractors during the operation and maintenance period.

The plant appears to be in good working order and maintenance standards are good. The plant is manually operated but electrical valve actuators are in use. It is understood that a proposal to install a SCADA system has been prepared.

Records of pump running hours, load, filter backwashing and clear water reservoir levels are logged. However records of maintenance, repairs and maintenance/breakdown problems are not maintained.

Disinfection is achieved using gas chlorination. The chlorination is delivered using three, one tonne cylinders. Maintenance, installation standards and operation practices for chlorine use are poor. There are no facilities to adequately detect or contain gas leaks. Personal breathing apparatus is available in the laboratory but is not used or maintained.

The 52 MLD plant has its own process control laboratory. Records are logged by the laboratory staff for chemical usage and treatment parameters. Records are kept for pump running hours, load, filter backwashing and clear water reservoir levels. However records of maintenance, repairs and breakdown problems are not maintained.

An Electro-chlorination system is used for disinfection. This appears to be in good working order and maintenance standards are generally good (except for the chlorination room). Gas chlorination using one tonne cylinders is available for back-up purposes but appears to be in relatively poor condition. There are no facilities to detect or contain leaks.

Tables M31.2.3 and M31.2.4 and Figure M31.2.2 show the flow rate data for Opa/Curti Treatment Plants. Table M31.2.5 and Figure M31.2.3 show the data on monthly water quality at Curti Water Treatment Plant. Table M31.2.6 shows records on power outages at Opa Water Treatment Plant.

Table M31.2.1 Summary of Asset Register of Opa Water Treatment Plant (1/2)

Name of Facility		8 MLD (1.76 MGD)		12 MLD (2.5 MGD)	
		Contents of Facility	Remarks	Contents of Facility	Remarks
Raw Water Intake & Raw Water Transmission Facility	Intake Well & Connecting Pipe	D400mm × 1 Line, D300mm × 1 Line	Khandepar River	D400mm × 1 Line,	Khandepar River
	Pump & Motor	Horizontal Centrifugal Pump: $^{Q}334m^3/hr \times {}^{H}22m \times$ 37kw × 3 units (1 or 2 – Standby)	Design Cap. of Intake Pump = 8～16MLD	Horizontal Centrifugal Pump: $^{Q}552m^3/hr \times {}^{H}27.5m \times$ 75kw × 3 units (1 or 2 – Standby)	Design Cap. of Intake Pump = 13.2～26.5MLD
	Raw Water Transmission Main	D350mm × 55m × C.I.P. ×1 Line		D450mm × 45m × C.I.P. ×1 Line	
Treatment Facility	Aerator	Not Provided		Cascade Type: 1 unit	
	Flash Mixer & Weir	Not Provided		1 unit (for Chemical Dosing)	
	Clariflocculator	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: $^{D}12.5m$ (Flocc. Zone ??m) × $^{WD}5.00m$ × 1 unit Detention Period: Flocculation - ??min Clarifier - ? hrs [1] Overall – 1.75 hrs Surface Loading: ?? $m^3/m^2/d$ (?? mm/min) [2]	1): 2～2.5 hrs 2): 30～40$m^3/m^2/d$ Using dosing point and by-pass flow of rqw water due to malfunction of equipment.	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: $^{D}22.73m$ (Flocc. Zone ??m) × $^{WD}5.00m$ × 1 unit Detention Period: Flocculation - ??min Clarifier - ? hrs [1] Overall – 3.86 hrs Surface Loading: ?? $m^3/m^2/d$ (?? mm/min) [2]	1): 2～2.5 hrs 2): 30～40$m^3/m^2/d$
	Filter	Gravity Rapid Sand Filter Type $^{W}2.5m \times {}^{L}7.5m \times$ 2cells/basin × 5 basins Effective Size of Sand:0.71mm, Depth of Sand: ?.??m Filter Area: 9.4 m^2/cell, 18.8 m^2/basin Filtration Rate: 3.75 m^3/hr [3] (90 m/d) Air Scouring Rate: ??m/hr/cell [4] (?? m^3/min/m^2/cell) Backwash Rate: 38.4 m/hr/cell [5] (0.64 m^3/min/m^2/cell)	Based on Specifications of Air Blower & Backwash Pump 3): 4.8～6.0m/hr 4): 36～54m/hr 5): 24～36m/hr	Gravity Rapid Sand Filter Type $^{W}5.5m \times {}^{L}5.0m \times$ 2cells/basin × 4 basins Effective Size of Sand:0.71mm, Depth of Sand: ?.??m Filter Area: 13.75 m^2/cell, 27.5 m^2/basin Filtration Rate: 4.8 m/hr [3] (115 m/d) Air Scouring Rate: ??m/hr/cell [4] (?? m^3/min/m^2/cell) Backwash Rate: 33 m/hr/cell [5] (0.55 m^3/min/m^2/cell) - (150m^3 Backwash Tank)	Based on Specifications of Air Blower & Backwash Pump 3): 4.8～6.0m/hr 4): 36～54m/hr 5): 24～36m/hr
Chemical Feeding Facility	Alum Feeding Facility	Dry Aluminum Sulfate Solution Tank: 2 units		Dry Aluminum Sulfate Solution Tank: 2 units	
	Lime Feeding Facility	Using 12 MLD facility		Powder Lime Solution Tank: 5 units	
	Disinfection Facility	Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 1 unit		Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 1 unit	
Laboratory	Frequency of Sampling & Analysis	In-Service, Jar Test: Not in Service Every Hour: pH, Turbidity, R-Cl Daily: Turbidity, pH, Alkalinity, Hardness, Chlorine, Mn, Fe, D.O.,R-Cl			
Clear Water Transmission Facility	Clear Water Sump	Volume=175 m^3×1 unit, Retention Time: 0.5 hr		Volume=1,350 m^3×1 unit, unit, Retention Time: 2.57 hr	
	Transmitted Pump & Motor	Horizontal Centrifugal Pump: $^{Q}334m^3/hr \times {}^{H}160m \times$ 215kw × 3 units (1 or 2 – Standby)	Design Cap. of Pump = 8 ～16MLD	Horizontal Centrifugal Pump: $^{Q}545m^3/hr \times {}^{H}168m \times$ 450kw × 3 units (1 or 2 – Standby)	Design Cap. of Pump = 13～26MLD
	Transmission Line	D350mm × 800m × (C.I.P. + M.S.P.) ×1 Line		D400mm×1,600m×(C.I.P. & M.S.P.)×1 Line D500mm×1,600m×(C.I.P. & M.S.P.)×1 Line	
	Clear Water Reservoir (MBR)	Volume=800 m^3×4 units, Total Volume = 3,200 m^3 Retention Time: ?? hr			

Note: 1) ～ 4) are referring to "Manual on Water Supply and Treatment, Third Edition – Revised and Updated, May 1999"

Table M31.2.1 Summary of Asset Register of Opa Water Treatment Plant (2/2)

Name of Facility		72 MLD (16 MGD)		40 MLD	
		Contents of Facility	Remarks	Contents of Facility	Remarks
		Common for 2 Plants			
Raw Water Intake & Raw Water Transmission Facility	Intake Well & Connecting Pipe	D450mm × 6 Lines, D450mm × 1 Line	Khandepar River	Jack Well & pump House: Dia. 9.0m Connecting Pipe: Not Provided	Khandepar River
	Pump & Motor	Horizontal Centrifugal Pump: ^{Q}864m^3/hr × ^{H}176m × 550kw × 2 units ^{Q}648m^3/hr × ^{H}176m × 550kw × 2 units ^{Q}648m^3/hr × ^{H}176m × 475kw × 3 units (2 or 3 – Standby)	Design Cap. of Intake Pump for 2 Plants = 122 ～148MLD	Vertical Pump: ^{Q}1,250m^3/hr × ^{H}190.5m × 875kw × 3 units (1 –Standby)	Design Cap. of Intake Pump for 2 Plants = 122 ～148MLD
	Raw Water Rising Main	D750mm × 1,600m × C.I.P. ×2 Lines		D750mm × 1,900m × C.I.P. ×1 Line	
Treatment Facility	Stilling Chamber	Not Provided		^{W}3.0m × ^{L}3.0m × ^{WD}3.1m ×1 basin Detention period: 1 min	
	Aerator	Cascade Type: 1 unit		Cascade Type: 1 unit	
	Flash Mixer & Parshal Flume	Each 1 unit (for Chemical Dosing)		Each 1 unit (for Chemical Dosing)	
	Contact Aeration Tank	Not Provided		^{D}17.5m ×^{WD}5.0m ×1 basin Detention period: 41 min	
	Clarifier / Settling Tank (Clariflocculator)	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: ^{D}40.0m (Flocc. Zone ??m) × ^{WD}5.00m × 2 units Detention Period: Flocculation - ??min Clarifier - ? hrs [1] Overall – 4.0 hrs Surface Loading: ?? m^3/m^2/d (?? mm/min) [2]	1): 2～2.5 hrs 2): 30～40m^3/m^2/d	Reactor Clarifier Type with Center Feed / Peripheral Collection Flocculation & Clarifier: ^{D}30.0m (Flocc. Zone 11.0m) × ^{WD}5.00m × 1 unit Detention Period: Flocculation - 18min Clarifier – 1.9 hrs [1] Surface Loading: 68.7 m^3/m^2/d (47.7 mm/min) [2]	1): 1～1.5 hrs 2): 40～50m^3/m^2/d
	Filter	Gravity Rapid Sand Filter Type ^{W}12.2m×^{L}7.6m×2cells/basin×6 basins: Filter Area=92.7m^2 /basin ^{W}9.92m×^{L}6.98m×2cells/basin×1 basin: Filter Area=69.1m^2 /basin ^{W}10.88m×^{L}7.6m×2cells/basin×1 basin: Filter Area=82.7m^2 /basin Effective Size of Sand: 0.71mm, Depth of Sand: ?.??m Filtration Rate: 4.46 m/hr [3] (107 m/d) Air Scouring Rate: ??m/hr/cell [4] (?? m^3/min/m^2/cell) Backwash Rate: ??.? m/hr/cell [5] (0.?? m^3/min/m^2/cell)	Based on Specifications of Air Blower & Backwash Pump 3): 4.8～6.0m/hr 4): 36～54m/hr 5): 24～36m/hr	Gravity Rapid Sand Filter Type ^{W}4.5m × ^{L}9.5m × 2cells/basin × 4 basins Effective Size of Sand: 0.71mm, Depth of Sand: ?.??m Filter Area: 21.4 m^2/cell, 42.8 m^2/basin Filtration Rate: 10.2 m/hr [3] (245 m/d) Air Scouring Rate: ??m/hr/cell [4] (?? m^3/min/m^2/cell) Backwash Rate: 34.8 m/hr/cell [5] (0.58 m^3/min/m^2/cell) - (600m^3 Backwash Tank)	Based on Specifications of Air Blower & Backwash Pump 3): Higher than Standard(4.8～6.0m/hr) 4): 36～54m/hr 5): 24～36m/hr
	Dirty Water Sump	Not Provided		^{D}13.0m×^{WD}1.5m×1 basin, Volume:199 m^3	
Chemical Feeding Facility	Alum Feeding Facility	Dry Aluminum Sulfate Solution Tank: 3 units		Dry Aluminum Sulfate Solution Tank: 3 units	
	Lime Feeding Facility	Powder Lime Solution Tank: 2 units		Powder Lime Solution Tank: 3 units	
	Disinfection Facility	Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 1 unit		Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 1 unit	
Laboratory	Frequency of Sampling & Analysis	In-Service, Jar Test: Not in Service Every Hour: pH, Turbidity, R-Cl Daily: Turbidity, pH, Alkalinity, Hardness, Chlorine, Mn, Fe, D.O.,R-Cl		In-Service, Jar Test: Not in Service Every Hour: pH, Turbidity, R-Cl Daily: Turbidity, pH, Alkalinity, Hardness, Chlorine, Mn, Fe, D.O.,R-Cl	
Clear Water Reservoir		Volume= 3,030 m^3×3 units,		Volume= 5,000 m^3×2 units,	

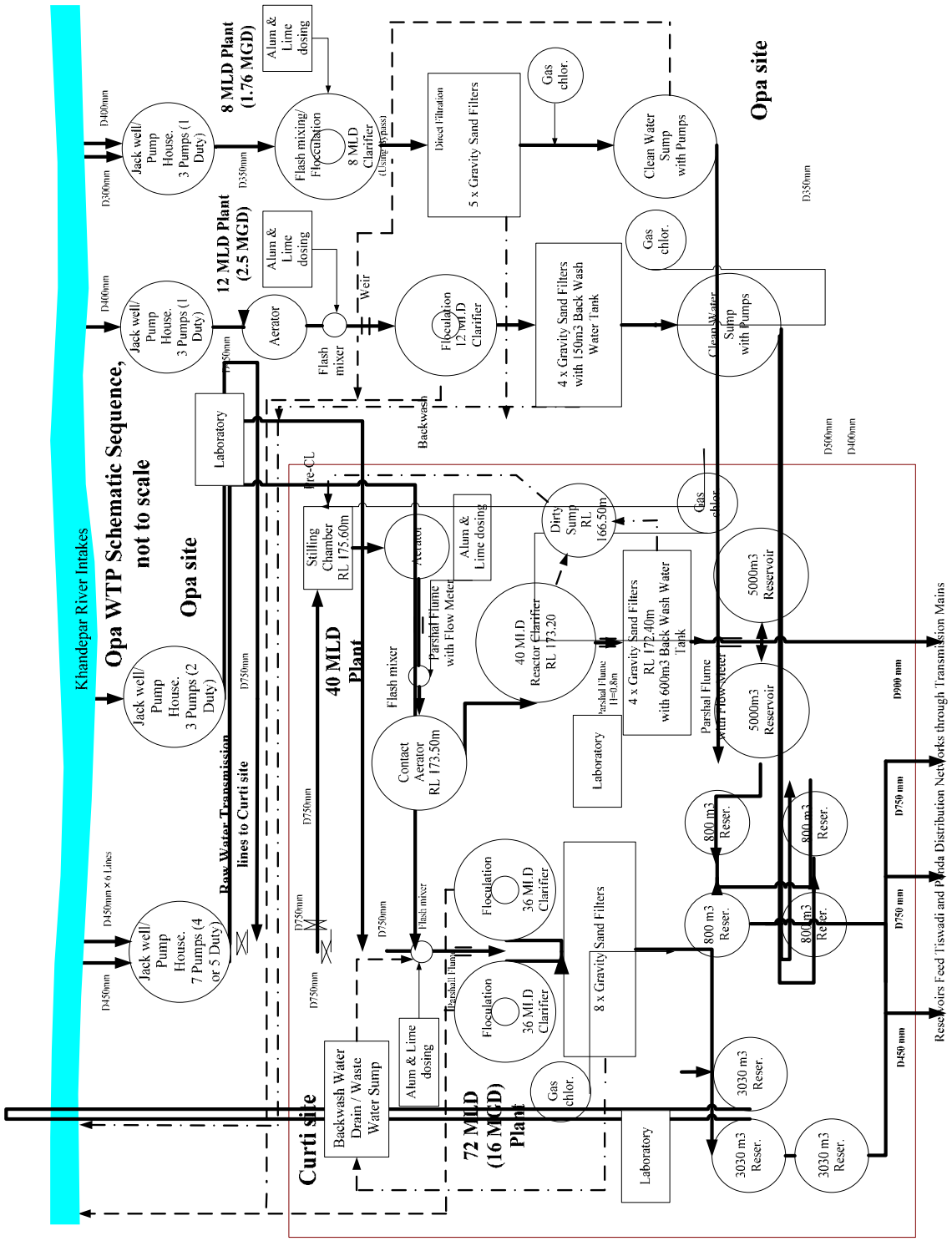

Figure M31.2.1 Schematic Sequence of Opa Water Treatment Plant

Table M31.2.2 Present Conditions of Opa Water Treatment Plant (1/8)

Item			Contents													
Background																
Covered Area for Water Supply		Taluka	Ponda & Part of Tiswadi (Panaji)													
Name of Plant			Opa W.T.P.						Curti W.T.P.							Total
Number & Name of W.T.P.		Number	(1) :8 MLD		Remark	(2) : 12MLD		Remark	(3) : 72MLD			Remark	(4) : 40MLD		Remark	
Capacity of Plant		MGD	1.76		Imperial Gallon=4.546 ℓ	2.5		Imperial Gallon=4.546 ℓ	16			Imperial Gallon=4.546 ℓ				
		MLD	8.00			11.37			72.74							
		MLD	8		Nominal	12		Nominal	72 : Augmented from 55MLD to 72MLD				40		Nominal	132
		m^3/d	8,000			12,000			72,000				40,000			132,000
Raw Water Resources		River	Khandepar			Khandepar			Khandepar				Khandepar			
		Dam														
Year of Construction		Year											2002 - 03			
Year of Commission		Year	1957			1967			1972				2004			
Name of Facility			**Contents of Facility**													**Total**
			Opa W.T.P.						**Curti W.T.P.**							
			(1) :8 MLD		**Remark**	**(2) : 12MLD**		**Remark**	**(3) : 72MLD**			**Remark**	**(4) : 40MLD**		**Remark**	
Design Capacity of Raw Water Intake & Treatment Facility		MLD	8.40		: 5% Loss	12.60		: 5% Loss	75.60			: 5% Loss	42.00		: 5% Loss	138.60
		m^3/d	8,400			12,600			75,600				42,000			138,600
Head Water Works : Raw Water Intake																
Intake Well / Jack Well & Pump House			Intake Well			Intake Well			Intake Well & Jack Well							
	Diameter	m	-			-			-				9.0			
	Width	m	4.50			6.0			9.0							
	Length	m	2.00			2.0			4.0							
	H.W.L. : Design	m														
	L.W.L. : Design	m	2.42			2.42			2.42				2.42			EL of Weir
Connecting Pipe	Diameter	mm	400	300		400			450	450	450	450				
	Number of Line	No.	1	1		1			2	2	2	1				
	Length	m														
	Material															
Raw Water Pump									Intake Well				Jack Well			
									①⑥	②⑤	③④	⑦				
	Capacity	ℓ/sec	92.8	92.8		153.3	153.3		180	240	180	180	347.22			
		ℓ/min	5,566.7	5,566.7		9,200	9,200	Based on Photo	10,800	14,400	10,800	10,800	20,833			
		m^3/min	5.57	5.57		9.20	9.20		10.80	14.40	10.80	10.80	20.83			
		m^3/hr	334.0	334.0		552.0	552.0		648.0	864.0	648.0	648.0	1250.0			
		m^3/d	8,016	8,016		13,248	13,248		15,552	20,736	15,552	15,552	30,000			
	Number	unit	2	1		1	2		2	2	2	1	3			
	Stand-by	unit	2			2			①⑥	②⑤	①③④⑥or②⑤		1			
									2	2	earch 1 unit			Max	Min	Min
	Total Capacity	m^3/d	8,000			13,200			72,600	62,200	67,400	15,600	60,000	148,200	122,200	143,400
	Head	m	22.0	22.0		27.5	27.5		176.0	176.0	176.0	176	190.5			
	Type of Pump		Centrifugal			Centrifugal			Centrifugal				Vertical			
	Maker		KSB			M & P	Jyoti		KBL	KBL			KBL			
	Year of Manufacture		1955			1992	1994		1972	2001		1987	2002			
	Assessment of Condition		Working / Required Replacement			Working / Required Replacement			Working				Working :1 unit Under repairing			
Raw Water Motor	Motor Output	HP	50			101	101		637	738	738	637	1,173			
		kW	37			75	75		475	550	550	475	875			
	Number	Unit	3			1	2		2	2	2	1	3			
	Maker		CG			Jyoti	Jyoti		CG	KEL	KEL		KEL			
	Year of Manufacture		1955			1994	1994		1972	1994	2001		2002			
	Assessment of Condition		Working / Required Replacement			Working / Required Replacement				Retrofitted			Working			
									①③④⑥⑦Required Replacement							

Table M31.2.2 Present Conditions of Opa Water Treatment Plant (2/8)

Name of Facility			Contents of Facility												Total
			Opa W.T.P.						Curti W.T.P.						
			(1) :8 MLD		Remark	(2) : 12MLD		Remark	(3) : 72MLD		Remark	(4) : 40MLD		Remark	
Raw Water Transmission Line to Aerator	Diameter	mm	350			450			750	750		750			
	Length	m	55			45			1,600	1,600	Raw Water Rising Main	1,900		Raw Water Rising Main	
	Material		CIP			CIP			CIP	CIP		CIP			
	Velocity	m/sec													
	Head Loss	m													
	Assessment of Condition	Pipe	Working			Working			Working.			Working			
		Valve	Need Replacement			Leakage through Gland			Leakage through Gland, NRB&SIV to be Repaced			Working			
Water Treatment Plant															
Stilling Chamber	Dsign Capacity	m^3/min/unit	-	-	-	-	-	-	-	-	-	29.17			
		m^3/hr/unit	-	-	-	-	-	-	-	-	-	1,750			
		m^3/d/unit	-	-	-	-	-	-	-	-	-	42,000			
	Number	Unit	-	-	-	-	-	-	-	-	-	1			
	Width	m	-	-	-	-	-	-	-	-	-	3.00			
	Length	m	-	-	-	-	-	-	-	-	-	3.00			
	Water Depth	m	-	-	-	-	-	-	-	-	-	3.10			
	Volume	m^3	-	-	-	-	-	-	-	-	-	27.9			
	Retention Time	min	-	-	-	-	-	-	-	-	-	0.96			
	Water Level	m	-	-	-	-	-	-	-	-	-	175.6			
	Assessment of Condition		-	-	-	-	-	-	-	-	-	Working			
Aerator	Capacity	m^3/hr	Not Provided	-	-	525.0			Not Provide	-	-	1,750.0			
		m^3/d	-	-	-	12,600			-	-	-	42,000			
	Diameter	m	-	-	-	5.0	Cascade Type		-	-	-	8.0	Cascade Type		
	Number	Unit	-	-	-	1			-	-	-	1			
	El. of Top Aerator	m	-	-	-				-	-	-	175.50			
	Assessment of Condition		-	-	-	Working			-	-	-	Working			
Parshal Flume/Weir	Assessment of Condition		Not Provided	-	-										
			-	-	-	Working			Working			Working			
Contact Aeration Tank	Dsign Capacity	m^3/min/unit	-	-	-	-	-	-	-	-	-	29.2			
		m^3/hr/unit	-	-	-	-	-	-	-	-	-	1,750			
		m^3/d/unit	-	-	-	-	-	-	-	-	-	42,000			
	Number	Unit	-	-	-	-	-	-	-	-	-	1			
	Diameter	m	-	-	-	-	-	-	-	-	-	17.50			
	Water Depth	m	-	-	-	-	-	-	-	-	-	5.00			
	Volume	m^3	-	-	-	-	-	-	-	-	-	1,202.6			
	Retention Time	min	-	-	-	-	-	-	-	-	-	41.2			
	Water Level	m	-	-	-	-	-	-	-	-	-	173.50			
	Assessment of Condition		-	-	-	-	-	-	-	-	-	Working			
Flash Mixer			Not Provided	-	-										
	Assessment of Condition		-	-	-	Working			Working			Working			

Table M31.2.2 Present Conditions of Opa Water Treatment Plant (3/8)

Name of Facility			Contents of Facility										Total
			Opa W.T.P.					Curti W.T.P.					
			(1) :8 MLD	Remark	(2) : 12MLD	Remark	(3) : 72MLD	Remark		(4) : 40MLD	Remark		
Clarifiers / Settling Tank (Coagulation Basin)	Dsign Capacity	m^3/min/unit	5.8		8.8		26.3			29.2			
		m^3/hr/unit	350.0		525.0		1,575.0			1,750.0			
		m^3/d/unit	8,400		12,600		37,800			42,000			
	Number	Unit	1		1		2			1			
	Type of Clarifier		Circular Horizontal Flow Type with Center Feed/Peripheral Collection		Circular Horizontal Flow Type with Center Feed/Peripheral Collection		Circular Horizontal Flow Type with Center Feed/Peripheral Collection			Reactor Clarifier Type with Center Feed/Peripheral Collection			
	Overall Diameter	m	12.50		22.73		40.00			30.00			
	Floccul. Zone Dia.	m								11.00			
	Water Depth	m	5.00		5.00		5.00			5.50			
	Frequency of Desludging		Using for By-pass		General Season : Once a Day Monsoon Season: Twice a Day		General Season : Once a Day Monsoon Season: Twice a Day			General Season : Once a Day Monsoon Season: Twice a Day			
	Volume												
	Overall	m^3/unit	613.6		2,028.9		6,283.2			3,887.7			
	Floccul. Zone	m^3/unit	0.0		0.0		0.0			522.7			
	Clarifying Zone	m^3/unit	613.6		2,028.9		6,283.2			3,365.0			
	Retention Time												
	Overall	hr	1.8		3.9		4.0			2.2			
	Floccul. Zone		0.00		0.00		0.00			0.30			
	Clarifying Zone		1.75		3.86		3.99			1.92			
	Surface Area	m^2/unit	122.7		405.8		1,256.6			611.8			
	Surface Loading	mm/min	47.5		21.6		20.9			47.7			
	W.L. of Clarifier	m								173.20			
	Assessment of Condition		Required Overhauling / Replacement		Working		Working			Working			
Flocculator	Number	unit											
	Assessment of Condition		Required Overhauling / Replacement		Working		Working			Working			
Drive Arrangement	Number	unit											
	Assessment of Condition		Required Overhauling / Replacement		Working		Working			Working			
Filter	Number	Unit	5		4		6	1	1	4			
	Type of Filter		Rapid Sand Filter		Rapid Sand Filter		Rapid Sand Filter			Rapid Sand Filter			
	Design Capacity	m^3/hr/unit	70.0		131.3					437.5			
		m^3/d/unit	1,680		3,150					10,500			
	Width	m	7.50		5.50		12.20	9.90	10.88	4.50			
	Length	m	2.50		5.00		7.60	6.98	7.60 Total Area	9.50			
	Filtered Area	m^2/unit	18.8		27.5		92.7	69.1	82.7 708.1	42.8			
	Velocity	m^3/d/m^2	89.6	OK	114.5	Ok	106.8		OK	245.6	High Rate		
	Filter Media												
	E.S. of Sand	mm	Standard Size : 0.71mm		Standard Size : 0.71mm		Standard Size : 0.71mm			Standard Size : 0.71mm			
	Depth of Sand	mm											
	Type of Underdrain		Plasitic Nozzle		Plasitic Nozzle		Plasitic Nozzle			Plasitic Nozzle			
	Year Replacement of Media		30mm Partial Replacement in '97-'98		30mm Partial Replacement in '97-'98		Upper Media Layer Topped up in '01			No Replacement			
	W.L. of Filter	m								172.40			
	Assessment of Condition		Working		Working		Working			Working			

Table M31.2.2 Present Conditions of Opa Water Treatment Plant (4/8)

Name of Facility			Contents of Facility										Total
			Opa W.T.P.				Curti W.T.P.						
			(1) :8 MLD	Remark	(2) : 12MLD	Remark	(3) : 72MLD	Remark	(4) : 40MLD	Remark			
Filter Washing	Air Scouring Rate	$m^3/min/m^2$											
	Air Scouring Time	min	5	Act.: 3	5		5		5	Act.: 3			
	Backwash Rate	$m^3/min/m^2$	0.64	OK	0.55	OK	0.00	?	0.58	250m3/time	OK		
	Back Wash Drain	m^3/Unit	93.8	0.5m3/min/m2	137.5	0.5m3/min/m2	442.6	0.5m3/min/m2	213.8		0.5m3/min/m2		
	Backwashing Time	min	10	Act.: 4	10		10		10		Act.: 7		
	Frequency of Washing		General Season : Once a Day		General Season : Once a Day		General Season : Once a Day		General Season : Once a Day				
			Monsoon Season: 1~2 Times a Day		Monsoon Season: 1~2 Times a Day		Monsoon Season: 1~2 Times a Day		Monsoon Season: Twice a Day				
Backwash or Lifting Pump & Motor	Capacity	m^3/min	6.0		7.6	Lifting Pump & Motor 150m3 Back Wash Water Tank	0.0				Lifting Pump & Motor 600m3 Back Wash Water Tank		
		m^3/hr	360		456.0				300.0				
	Number	unit	2		2		2		2				
	Stand-by	unit	1		1		1		1				
	Total Capacity	m^3/min	6.0		7.6		0.0						
	Head	m	20		20.0		20.0		15.0				
	Type of Pump		Centrifugal		Centrifugal		Centrifugal		Centrifugal				
	Motor Output	HP	20		25.0		50.0		24.8				
		kW	15		18.6		37.3		18.5				
	Assessment of Condition		Working		Working		Working		Working				
Air Blower	Capacity	m^3/min					900						
		m^3/hr											
	Number	unit	3				2		2				
	Stand-by	unit	2				1		1				
	Total Capacity	m^3/min											
	Head												
	Motor Output	HP	20				20						
		kW	15						30				
	Assessment of Condition												
Clear Water Sump	Width	m	15.00		27.5		-	-	-	-	-		
	Length	m	6.00		18.0		-	-	-	-	-		
	Water Depth	m	1.94		2.73		-	-	-	-	-		
	Number	Unit	1		1		-	-	-	-	-		
	Volume	m^3	175		1,350		-	-	-	-	-		
	Last Date of Cleaning		Pediodical		Pediodical		-	-	-	-	-		
	Total	m^3	175		1,350		-	-	-	-	-		
	Detention Time	hr	0.50		2.57		-	-	-	-	-		
	Assessment of Condition		Working		Need Plastering		-	-	-	-	-		

Table M31.2.2 Present Conditions of Opa Water Treatment Plant (5/8)

Name of Facility			Contents of Facility										Total
			Opa W.T.P.						Curti W.T.P.				
			(1) :8 MLD	Remark	(2) : 12MLD	Remark	(3) : 72MLD	Remark	(4) : 40MLD	Remark			
Transmitted (Clear Water) Pump	Capacity	ℓ/sec	93		151.4		N.A.	-	N.A.	-			
		m^3/min	5.57		9.08		-	-	-	-			
		m^3/hr	334.0		545.0		-	-	-	-			
		m^3/d	8,016		13,080		-	-	-	-			
	Number	unit	3		3		-	-	-	-			
	Stand-by		2		2		-	-	-	-			
	Total Capacity	m^3/d	8,000		13,000		-	-	-	-			
	Head	m	160.0		168.0		-	-	-	-			
	Type of Pump		Centrifugal		Centrifugal		-	-	-	-			
	Maker		KSB		Mather Platt		-	-	-	-			
	Year of Manufacture		1958		1967		-	-	-	-			
	Assessment of Condition		Working		Working		-	-	-	-			
Transmitted (Clear Water) Motor	Motor Output	HP	288		603.45		N.A.	-	N.A.	-			
		kW	215		450		-	-	-	-			
	Number	Unit	3		3		-	-	-	-			
	Maker		Siemens		CG		-	-	-	-			
	Year of Manufacture				2000	Replaced	-	-	-	-			
	Assessment of Condition		Working		Working		-	-	-	-			
Transmission Lines	Diameter	mm	350	350	400	500	N.A.	-	N.A.	-			
	Length	m	800	800	1,600	1,600	-	-	-	-			
	Material		CIP	MS	CIP, MS	CIP, MS	-	-	-	-			
	Velocity	m/sec					-	-	-	-			
	Head Loss	m					-	-	-	-			
	Assessment of	Pipe	Working	Working	MS Line Need Replacement		-	-	-	-			
	Condition	Valve	Working	Working	Non-Return Valve Need Replacement		-	-	-	-			
Parshal Flume			N.A.	-	N.A.	-	N.A.	-					
	Assessment of Condition		-	-	-	-	-	-	Working				
Clear Water Reservoir (MBR)	Diameter	m					28.0		40.0				
	Water Depth	m					5.0		4.0				
	Number	Unit	4				3	RCC, MBR	2	RCC, MBR			
	Volume	m^3	800				3,079	3,030	5,027	5,000			
	Last Date of Cleaning		Pediodical				Pediodical						
	Total	m^3	3,200				9,236	9,090	10,053	10,000			22,290
	Detention Time	hr											3.86
	Assessment of Condition		Working				Working		Working				
Dirty Water Sump	Number	Unit	-	-	-	-	-	-	1				
	Diameter	m	-	-	-	-	-	-	13.00				
	Water Depth	m	-	-	-	-	-	-	1.50				
	Volume	m^3/unit	-	-	-	-	-	-	199.1				
	Retention Time	min	-	-	-	-	-	-	213.8 Wash Drain				
	Water Level	m	-	-	-	-	-	-	168.50				
			-	-	-	-	-	-					
	Assessment of Condition		-	-	-	-	-	-					

Table M31.2.2 Present Conditions of Opa Water Treatment Plant (6/8)

Name of Facility			Contents of Facility										Total
			Opa W.T.P.					Curti W.T.P.					
			(1) :8 MLD	Remark	(2) : 12MLD	Remark	(3) : 72MLD	Remark	(4) : 40MLD	Remark			
Chemical Facility													
Alum Feeding Facility	Capacity	kg/hr											
		m^3/unit											
	Diameter	m											
	Width	m	3.50		2.5		2.4		2.5				
	Length	m	1.70		2.7		2.5		2.5				
	Height	m	2.30		2.0		2.3						
	Volume	m^3	13.7		13.5		13.8		0.0				
	Number	Unit	2		2		3		3				
	Stand-by												
	Assessment of Condition		Working		Working		Working		Working				
Lime Feeding Facility	Capacity	kg/hr	-										
		m^3/unit	-										
	Diameter	m											
	Width	m					2.4		2.0				
	Length	m					2.5		2.0				
	Height	m					2.3						
	Volume	m^3					13.8						
	Number	Unit	-		5		2		3				
	Stand-by												
	Assessment of Condition		-		Working		Working		Working				
Disinfection System	Chemical Used		Liquid Chlorine / Bleaching Powder		Liquid Chlorine / Bleaching Powder		Liquid Chlorine / Bleaching Powder		Liquid Chlorine / Bleaching Powder				
	Type of Plant & Machinery		Aquapura Make		Aquapura Make		Aquapura Chlorinator		Vaccum Operated				
	Capacity	kg/hr	1.0		7.0		6.0		10.0				
	Number	Unit	1		1		1		1				
	Stand-by												
	Safty Measures Taken		Safety Mask/Oxygen Cylinder/Gloves Available		Safety Mask/Oxygen Cylinder/Gloves Available		Safety Mask/Oxygen Cylinder/Gloves Available		Safety Mask/Oxygen Cylinder/Gloves Available				
	Commissioned		1997				1999/2003		2,003				
	Assessment of Condition		Need Replacement		Need Replacement		Need Replacement		Good				
Substation (Transformers)													
Number of Transformer													
Pole Mounted / Pad Mounted			Pad		Pad		Pad		Pad		Pad		
Capacity		kVA	1,000	for 8 MLD	3,150	for 12 MLD	3,150	for 72 MLD	2,500	for 40 MLD	350 for Culti		
Number		Unit	2		1		1		1		1		
	Stand-by		1		Nil		Nil		Nil		Nil		
Commissioned			1972		1972		2002		1996				
Likely Design Life		Year					15		15				
Last Replacement													
Assessment of Condition			Overhauled		Working		Good		Working		Working		

Table M31.2.2 Present Conditions of Opa Water Treatment Plant (7/8)

Name of Facility	Contents of Facility								Total
	Opa W.T.P.				Curti W.T.P.				
	(1) :8 MLD	Remark	(2) : 12MLD	Remark	(3) : 72MLD	Remark	(4) : 40MLD	Remark	
Laboratory									
Chemical Testing Laboratory	In-service (Exist)				In-service (Exist)		Exist at Curti		
Jar Testing									
Availability of Skilled Chemists	Available		Available		Available		Available		
Availability of Required Chemicals	Available		Available		Available		Available		
Use of Test Reports	As per Format		As per Format		As per Format		As per Format		
Frequency of Sampling	Residual Cl - Hourly & Other Tests Daily		Residual Cl - Hourly & Other Tests Daily		Residual Cl - Hourly, Mn Fortnightly & Other Tests Daily		pH, Turb., R-Cl - Hourly, other Tests Alternate Day		
General Quality of Water	Good		Good		Good		Good		
Raw Water Quality	Turbid., Low pH		Turbid., Low pH		Turbid., Low pH		Turbid., Low pH		
Clear Water Quality	Good		Good		Good		Good		
Equipment Status									
Flow Meters	-		No Flow Meter		Vetury Flume		Ultrasonic		
Other Operating Valves	working		Working		Working		Working		
Other Important Assets									
Valve's Condition	Working		Leakage through Gland		Working		Working		
Visible Leakage and Locations	Filter Valves from Grand		Nil		Leakage throgh Filter & Drain Valves		Nil		
Building Condition			Good		Good		Good Curti Quarters, Godown Requir Repair		
Wastewater Disposal Arrangements	Sludge Chamber to River		Sludge Chamber to River		Through Drainage System		Recirculation		

Present Condition of Opa & Curti Water Treatment Plant

No. 6

Organization & Staff Deployed (Common for 4 - Treatment Plant)

General Shift	Working Hour :	10:00 am → 05:45 pm					
	Staff Deployed :	Assistant Engineer		1 Person			
		Technical Assistant		1 Person			
		Junior Engineer		4 Persons			
		Chemist		Person			
		Electriciann		Person			
		Total	0	Person			
Shift in Plant Operation	2 - Shifting System Covering 24 Hours						
	Working Hour :	①: 08:30 am → 05:30 pm, ②: 05:30 pm → 08:30 am					
		(1) :8 MLD	(2) : 12MLD	(3) : 72MLD	(4) : 40MLD	(5) : Intake	
	Grouping Staff Deployed						
	Number of Groupe	3 Groupe	3 Groupe	3 Groupe	3 Groupe	3 Groupe	
	Number of Staff per Groupe	3 Persons	4 Persons	6 Persons	6 Persons	6 Persons	
	Maintenance Staff	3	3	3	3	6	
	Total	12	15	21	21	24	

Item		Contents				
Staff Deployed at the Plant		Common for 4 Plants at Opa Waterworks				
		Person	Qualification	Year of Service	Service at plant	
Management Staff - Engineers						
	Assistant Engineer	1	B.E.(Mech)	18	5	
	Technical Assistant	1	B.E.(Civil)	17	5	
	Junior Engineer	4	DEE/DME	17 Ave.	10 Ave.	
	L.D.C	1	S.S.C.	31	12	
	Drivers	4	S.S.C.	5 Ave.	5 Ave.	
	Sub-total	11				
Skilled Staff - Operators / Quality Testing						
	Lab - Technician	4	M. Sc/B. Sc	15 Ave.	15 Ave.	
	Chift In Charge	4	ITI	20 Ave.	20 Ave.	
	Electrician	4	ITI	23 Ave.	15 Ave.	
	Chlorine Operator	5	S.S.C./ITI	29 Ave.	29 Ave.	
	Filter Operator	1	S.S.C.	2 Ave.	2 Ave.	
	Mechanics	8	S.S.C./ITI	22 Ave.	22 Ave.	
	Skikked Workman	3	8 th	20 Ave.	20 Ave.	
	Assist. Electrician	2	ITI	2 Ave.	2 Ave.	
	Assist. Plumber	2	Certificate	2 Ave.	2 Ave.	
	Assist. Mistry	1	7 th	32 Ave.	32 Ave.	
	Assist. Mechanics	3	4 th	16 Ave.	16 Ave.	
	Supervisor	3	S.S.C./ITI	20 Ave.	17 Ave.	
	Pump Operator	2	7 th / ITI	15 Ave.	15 Ave.	
	Pump Attendant	4	7 th / S.S.C.	17 Ave.	17 Ave.	
	Operator	2	ITI	23 Ave.	19 Ave.	
	Sub-total	48				
Unskilled Staff		33	- Workman, Labourer, Khalashi, Watchman, Helper, etc.			
Total Number		92				

Table M31.2.3 Flow Rate of Opa Water Treatment Plant in 2003 (1/6)

MONTH : January-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Jan	35.50	23.00	29.22	25.24	48.25	11.00	5.20	23.33	7.77	45.58	56.98	118.20	106.38
2-Jan	36.58	23.71	19.42	16.78	40.48	22.42	10.60	21.42	7.13	45.50	56.88	115.09	103.58
3-Jan	60.25	39.04	21.67	18.72	57.76	24.00	11.35	23.92	7.96	32.83	41.04	118.12	106.31
4-Jan	60.08	38.93	24.00	20.74	59.67	24.00	11.35	23.92	7.96	35.83	44.79	123.78	111.40
5-Jan	19.25	12.47	40.58	35.06	47.54	24.00	11.35	24.00	7.99	48.00	60.00	126.88	114.19
6-Jan	12.25	7.94	40.75	35.21	43.15	24.00	11.35	23.83	7.94	48.00	60.00	122.43	110.19
7-Jan	18.75	12.15	5.17	4.46	16.61	19.83	9.38	24.00	7.99	48.00	60.00	93.99	84.59
8-Jan	42.08	27.27	22.92	19.80	47.07	28.67	13.56	24.00	7.99	48.00	60.00	128.62	115.76
9-Jan	22.00	14.26	29.50	25.49	39.74	48.00	22.70	23.92	7.96	48.00	60.00	130.41	117.37
10-Jan	50.92	32.99	5.25	4.54	37.53	28.00	13.24	24.00	7.99	48.00	60.00	118.77	106.89
11-Jan	31.25	20.25	31.92	27.58	47.83	41.25	19.51	23.92	7.96	48.00	60.00	135.30	121.77
12-Jan	35.33	22.90	24.67	21.31	44.21	38.75	18.33	24.00	7.99	48.00	60.00	130.53	117.48
13-Jan	10.00	6.48	48.00	41.47	47.95	33.42	15.81	23.92	7.96	47.92	59.90	131.62	118.46
14-Jan	35.75	23.17	30.92	26.71	49.88	24.00	11.35	23.83	7.94	48.00	60.00	129.17	116.25
15-Jan	48.00	31.10	20.92	18.07	49.18	32.17	15.21	23.83	7.94	48.00	60.00	132.33	119.09
16-Jan	36.00	23.33	24.00	20.74	44.06	46.67	22.07	24.00	7.99	48.00	60.00	134.13	120.72
17-Jan	23.25	15.07	33.83	29.23	44.30	57.83	27.36	23.92	7.96	48.00	60.00	139.62	125.66
18-Jan	0.00	0.00	48.00	41.47	41.47	48.00	22.70	23.92	7.96	48.00	60.00	132.14	118.93
19-Jan	23.50	15.23	32.75	28.30	43.52	43.50	20.58	23.50	7.83	48.00	60.00	131.93	118.73
20-Jan	21.58	13.99	34.75	30.02	44.01	56.42	26.69	24.00	7.99	48.00	60.00	138.69	124.82
21-Jan	2.17	1.40	24.17	20.88	22.28	37.58	17.78	24.00	7.99	48.00	60.00	108.05	97.25
22-Jan	32.33	20.95	23.92	20.66	41.62	40.17	19.00	21.75	7.24	48.00	60.00	127.86	115.07
23-Jan	46.33	30.02	14.08	12.17	42.19	37.50	17.74	23.92	7.96	48.00	60.00	127.89	115.10
24-Jan	27.75	17.98	19.67	16.99	34.97	38.58	18.25	24.00	7.99	47.92	59.90	121.11	109.00
25-Jan	30.50	19.76	24.00	20.74	40.50	48.00	22.70	23.92	7.96	48.00	60.00	131.17	118.05
26-Jan	12.42	8.05	26.67	23.04	31.09	36.83	17.42	20.33	6.77	42.42	53.02	108.30	97.47
27-Jan	6.92	4.48	28.17	24.34	28.82	44.33	20.97	24.00	7.99	48.00	60.00	117.78	106.00
28-Jan	32.58	21.11	22.33	19.30	40.41	34.00	16.08	23.25	7.74	44.67	55.83	120.07	108.06
29-Jan	17.42	11.29	28.33	24.48	35.77	27.67	13.09	23.50	7.83	47.17	58.96	115.64	104.07
30-Jan	20.58	13.34	24.00	20.74	34.07	46.00	21.76	23.92	7.96	48.00	60.00	123.80	111.42
31-Jan	24.00	15.55	24.00	20.74	36.29	43.00	20.34	24.00	7.99	48.00	60.00	124.62	112.16
Total	**875.33**	**567.22**	**827.55**	**715.00**	**1282.22**	**1109.58**	**524.83**	**731.75**	**243.67**	**1445.83**	**1807.29**	**3858.02**	**3472.21**
Maximum												**139.62**	**125.66**
Minimum												**93.99**	**84.59**
Average		**18.30**		**23.06**	**41.36**		**16.93**		**7.86**		**58.30**	**124.45**	**112.01**

MONTH : February-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Feb	24.00	15.55	24.00	20.74	36.29	48.00	22.70	24.00	7.99	48.00	60.00	126.98	114.29
2-Feb	23.50	15.23	23.92	20.66	35.89	32.00	15.14	23.58	7.85	47.08	58.85	117.74	105.96
3-Feb	20.25	13.12	28.00	24.19	37.31	40.83	19.31	23.92	7.96	48.00	60.00	124.59	112.13
4-Feb	10.83	7.02	32.08	27.72	34.74	43.00	20.34	23.67	7.88	47.17	58.96	121.92	109.73
5-Feb	14.33	9.29	26.17	22.61	31.90	24.58	11.63	23.92	7.96	48.00	60.00	111.49	100.34
6-Feb	24.00	15.55	24.00	20.74	36.29	44.25	20.93	23.92	7.96	48.00	60.00	125.18	112.66
7-Feb	22.67	14.69	16.33	14.11	28.80	45.58	21.56	24.00	7.99	48.00	60.00	118.35	106.52
8-Feb	59.92	38.83	0.00	0.00	38.83	43.08	20.38	22.08	7.35	48.00	60.00	126.56	113.90
9-Feb	47.08	30.51	4.83	4.18	34.69	25.17	11.90	24.00	7.99	48.00	60.00	114.58	103.12
10-Feb	19.00	12.31	24.00	20.74	33.05	41.17	19.47	24.00	7.99	48.00	60.00	120.51	108.46
11-Feb	24.00	15.55	21.17	18.29	33.84	28.05	13.27	16.00	5.33	48.00	60.00	112.44	101.19
12-Feb	12.75	8.26	8.08	6.98	15.25	48.00	22.70	24.00	7.99	48.00	60.00	105.94	95.35
13-Feb	48.00	31.10	0.00	0.00	31.10	48.00	22.70	23.92	7.96	48.00	60.00	121.77	109.60
14-Feb	23.83	15.44	18.17	15.70	31.14	45.83	21.68	23.75	7.91	34.12	42.65	103.37	93.04
15-Feb	23.67	15.34	23.67	20.45	35.78	22.00	10.41	23.17	7.71	46.58	58.23	112.13	100.92
16-Feb	20.67	13.39	24.17	20.88	34.27	41.42	19.59	23.50	7.83	46.75	58.44	120.13	108.11
17-Feb	33.33	21.60	12.67	10.94	32.54	37.33	17.66	23.67	7.88	47.58	59.48	117.56	105.81
18-Feb	21.50	13.93	21.92	18.94	32.87	34.92	16.52	21.42	7.13	45.50	56.88	113.39	102.05
19-Feb	16.08	10.42	31.83	27.50	37.93	19.67	9.30	23.50	7.83	47.00	58.75	113.80	102.42
20-Feb	38.17	24.73	25.33	21.89	46.62	20.17	9.54	22.83	7.60	45.00	56.25	120.01	108.01
21-Feb	11.25	7.29	29.58	25.56	32.85	20.68	9.78	22.33	7.44	44.75	55.94	106.01	95.41
22-Feb	26.67	17.28	12.50	10.80	28.08	24.00	11.35	23.92	7.96	48.00	60.00	107.40	96.66
23-Feb	11.00	7.13	15.42	13.32	20.45	26.33	12.46	24.00	7.99	48.00	60.00	100.90	90.81
24-Feb	23.17	15.01	16.17	13.97	28.98	12.58	5.95	23.75	7.91	46.33	57.92	100.76	90.68
25-Feb	22.08	14.31	13.58	11.74	26.05	35.25	16.67	23.75	7.91	44.83	56.04	106.67	96.00
26-Feb	20.08	13.01	19.75	17.06	30.08	22.08	10.45	22.67	7.55	45.58	56.98	105.05	94.55
27-Feb	21.08	13.66	21.58	18.65	32.31	30.25	14.31	23.50	7.83	46.00	57.50	111.94	100.75
28-Feb	21.17	13.72	24.00	20.74	34.45	37.58	17.78	23.83	7.94	43.67	54.58	114.75	103.27
Total	**684.08**	**443.29**	**542.92**	**469.08**	**912.37**	**941.82**	**445.48**	**650.58**	**216.64**	**1301.95**	**1627.44**	**3201.93**	**2881.73**
Maximum												**126.98**	**114.29**
Minimum												**100.76**	**90.68**
Average		**15.83**		**16.75**	**32.58**		**15.91**		**7.74**		**58.12**	**114.35**	**102.92**

Table M31.2.3 Flow Rate of Opa Water Treatment Plant in 2003 (2/6)

MONTH : March-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Mar	19.83	12.85	24.00	20.74	33.59	29.00	13.72	23.92	7.96	45.25	56.56	111.83	100.65
2-Mar	8.58	5.56	28.33	24.48	30.04	24.00	11.35	24.00	7.99	46.50	58.13	107.51	96.76
3-Mar	13.83	8.96	44.42	38.38	47.34	24.00	11.35	24.00	7.99	34.67	43.33	110.02	99.02
4-Mar	34.33	22.25	31.00	26.78	49.03	24.00	11.35	24.00	7.99	24.00	30.00	98.38	88.54
5-Mar	31.83	20.63	22.92	19.80	40.43	19.08	9.03	24.00	7.99	24.00	30.00	87.45	78.70
6-Mar	47.58	30.83	21.50	18.58	49.41	11.92	5.64	19.50	6.49	23.83	29.79	91.33	82.20
7-Mar	37.50	24.30	18.00	15.55	39.85	23.58	11.15	23.08	7.69	23.00	28.75	87.44	78.70
8-Mar	44.42	28.78	14.50	12.53	41.31	23.58	11.15	22.50	7.49	12.83	16.04	76.00	68.40
9-Mar	53.92	34.94	1.33	1.15	36.09	24.00	11.35	0.00	0.00	24.00	30.00	77.44	69.70
10-Mar	42.67	27.65	18.83	16.27	43.92	24.00	11.35	24.00	7.99	24.00	30.00	93.26	83.94
11-Mar	32.75	21.22	30.67	26.50	47.72	23.17	10.96	20.50	6.83	21.92	27.40	92.90	83.61
12-Mar	16.33	10.58	35.58	30.74	41.33	23.50	11.12			28.50	35.63	88.07	79.26
13-Mar	46.17	29.92	8.17	7.06	36.97	23.83	11.27	23.75	7.91	23.00	28.75	84.90	76.41
14-Mar	48.00	31.10	0.00	0.00	31.10	24.00	11.35	23.92	7.96	24.00	30.00	80.42	72.38
15-Mar	48.00	31.10	0.00	0.00	31.10	25.75	12.18	24.00	7.99	24.00	30.00	81.28	73.15
16-Mar	45.17	29.27	0.00	0.00	29.27	21.50	10.17	20.42	6.80	23.33	29.17	75.40	67.86
17-Mar	48.00	31.10	0.00	0.00	31.10	15.42	7.29	24.00	7.99	24.00	30.00	76.39	68.75
18-Mar	48.00	31.10	0.00	0.00	31.10	24.00	11.35	24.00	7.99	24.00	30.00	80.45	72.40
19-Mar	31.17	20.20	16.67	14.40	34.60	24.00	11.35	24.00	7.99	24.00	30.00	83.94	75.55
20-Mar	48.00	31.10	0.00	0.00	31.10	24.00	11.35	24.00	7.99	24.00	30.00	80.45	72.40
21-Mar	45.67	29.59	0.00	0.00	29.59	3.33	1.58	21.83	7.27	22.50	28.13	66.56	59.91
22-Mar	49.42	32.02	22.83	19.73	51.75	23.92	11.31	23.67	7.88	23.75	29.69	100.63	90.57
23-Mar	24.42	15.82	25.42	21.96	37.78	23.83	11.27	23.75	7.91	24.00	30.00	86.96	78.27
24-Mar	31.42	20.36	28.00	24.19	44.55	21.58	10.21	22.25	7.41	8.50	10.63	72.79	65.51
25-Mar	31.50	20.41	31.33	27.07	47.48	24.00	11.35	24.00	7.99	16.75	20.94	87.77	78.99
26-Mar	24.00	15.55	24.00	20.74	36.29	24.00	11.35	15.75	5.24	24.00	30.00	82.88	74.60
27-Mar	23.83	15.44	28.17	24.34	39.78	24.00	11.35	27.92	9.30	24.00	30.00	90.43	81.39
28-Mar	24.00	15.55	24.00	20.74	36.29	24.17	11.43	14.83	4.94	24.00	30.00	82.66	74.39
29-Mar	24.00	15.55	21.00	18.14	33.70	24.00	11.35	2.92	0.97	24.00	30.00	76.02	68.42
30-Mar	24.00	15.55	32.50	28.08	43.63	24.00	11.35	24.00	7.99	24.00	30.00	92.98	83.68
31-Mar	24.00	15.55	23.58	20.38	35.93	21.83	10.33	24.00	7.99	24.00	30.00	84.25	75.82
Total	**1072.33**	**694.87**	**576.75**	**498.31**	**1193.18**	**695.00**	**328.74**	**642.50**	**213.95**	**762.33**	**952.92**	**2688.79**	**2419.91**
Maximum												**111.83**	**100.65**
Minimum												**66.56**	**59.91**
Average		**22.42**		**16.07**	**38.49**		**10.60**		**7.13**		**30.74**	**86.74**	**78.06**

MONTH : April-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Apr	24.50	15.88	25.75	22.25	38.12	23.92	11.31	23.75	7.91	24.00	30.00	87.35	78.61
2-Apr	26.17	16.96	32.08	27.72	44.68	24.00	11.35	24.00	7.99	24.00	30.00	94.02	84.62
3-Apr	24.00	15.55	24.00	20.74	36.29	24.00	11.35	23.92	7.96	23.92	29.90	85.50	76.95
4-Apr	27.75	17.98	21.08	18.22	36.20	24.67	11.67	18.25	6.08	25.83	32.29	86.23	77.61
5-Apr	26.50	17.17	24.00	20.74	37.91	24.00	11.35	24.00	7.99	24.00	30.00	87.25	78.53
6-Apr	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	24.00	30.00	85.63	77.07
7-Apr	23.67	15.34	23.83	20.59	35.93	23.75	11.23	23.08	7.69	23.83	29.79	84.64	76.18
8-Apr	23.25	15.07	23.42	20.23	35.30	23.75	11.23	23.17	7.71	23.58	29.48	83.73	75.35
9-Apr	23.58	15.28	23.83	20.59	35.87	23.92	11.31	12.08	4.02	23.83	29.79	81.00	72.90
10-Apr	23.58	15.28	23.75	20.52	35.80	23.92	11.31	11.67	3.89	23.83	29.79	80.79	72.71
11-Apr	24.00	15.55	24.00	20.74	36.29	25.83	12.22	23.50	7.83	24.00	30.00	86.33	77.70
12-Apr	42.08	27.27	24.00	20.74	48.01	15.17	7.17	24.00	7.99	24.00	30.00	93.17	83.85
13-Apr	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	24.00	30.00	85.63	77.07
14-Apr	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	24.00	30.00	85.63	77.07
15-Apr	24.08	15.61	24.00	20.74	36.34	24.00	11.35	22.33	7.44	24.00	30.00	85.13	76.62
16-Apr	23.58	15.28	23.58	20.38	35.66	23.17	10.96	12.42	4.13	23.50	29.38	80.13	72.11
17-Apr	36.75	23.81	10.42	9.00	32.81	22.17	10.48	23.75	7.91	23.83	29.79	81.00	72.90
18-Apr	48.00	31.10	0.00	0.00	31.10	24.00	11.35	20.93	6.97	24.00	30.00	79.43	71.48
19-Apr	48.00	31.10	0.00	0.00	31.10	24.00	11.35	23.92	7.96	24.00	30.00	80.42	72.38
20-Apr	43.25	28.03	9.75	8.42	36.45	23.08	10.92	22.83	7.60	23.08	28.85	83.83	75.44
21-Apr	37.83	24.52	10.75	9.29	33.80	24.00	11.35	24.00	7.99	24.00	30.00	83.15	74.83
22-Apr	48.00	31.10	0.00	0.00	31.10	24.00	11.35	24.00	7.99	24.00	30.00	80.45	72.40
23-Apr	48.00	31.10	0.00	0.00	31.10	24.00	11.35	24.00	7.99	24.00	30.00	80.45	72.40
24-Apr	42.53	27.56	5.17	4.46	32.03	31.33	14.82	23.33	7.77	22.92	28.65	83.26	74.94
25-Apr	24.50	15.88	12.92	11.16	27.04	27.08	12.81	21.83	7.27	22.25	27.81	74.93	67.44
26-Apr	48.00	31.10	0.00	0.00	31.10	24.00	11.35	24.00	7.99	24.00	30.00	80.45	72.40
27-Apr	48.00	31.10	0.00	0.00	31.10	24.00	11.35	24.00	7.99	24.00	30.00	80.45	72.40
28-Apr	48.00	31.10	7.83	6.77	37.87	24.00	11.35	24.00	7.99	16.08	20.10	77.32	69.59
29-Apr	48.00	31.10	24.00	20.74	51.84	24.00	11.35	24.00	7.99	0.00	0.00	71.18	64.07
30-Apr	45.08	29.21	24.00	20.74	49.95	17.83	8.44	20.25	6.74	0.00	0.00	65.13	58.62
Total	**1022.70**	**662.71**	**494.17**	**426.96**	**1089.67**	**713.58**	**337.52**	**663.02**	**220.78**	**660.50**	**825.63**	**2473.60**	**2226.24**
Maximum												**94.02**	**84.62**
Minimum												**65.13**	**58.62**
Average		**22.09**		**14.23**	**36.32**		**11.25**		**7.36**		**27.52**	**82.45**	**74.21**

Table M31.2.3 Flow Rate of Opa Water Treatment Plant in 2003 (3/6)

MONTH : May-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-May	40.50	26.24	36.83	31.82	58.07	24.00	11.35	16.25	5.41	0.00	0.00	74.83	67.35
2-May	34.50	22.36	48.00	41.47	63.83	24.00	11.35	24.00	7.99	0.00	0.00	83.17	74.85
3-May	36.08	23.38	34.58	29.88	53.26	22.58	10.68	29.75	9.91	0.00	0.00	73.85	66.47
4-May	45.75	29.65	23.50	20.30	49.95	23.67	11.19	20.42	6.80	0.00	0.00	67.94	61.15
5-May	48.00	31.10	24.00	20.74	51.84	24.00	11.35	24.00	7.99	0.00	0.00	71.18	64.07
6-May	48.00	31.10	24.00	20.74	51.84	24.00	11.35	24.00	7.99	0.00	0.00	71.18	64.07
7-May	35.83	23.22	24.00	20.74	43.96	24.00	11.35	24.00	7.99	0.00	0.00	63.30	56.97
8-May	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	0.00	0.00	55.63	50.07
9-May	25.67	16.63	24.42	21.10	37.73	24.33	11.51	21.67	7.22	0.00	0.00	56.45	50.81
10-May	18.58	12.04	16.92	14.62	26.66	16.83	7.96	15.75	5.24	0.00	0.00	39.86	35.88
11-May	50.17	32.51	24.00	20.74	53.24	24.00	11.35	19.50	6.49	0.00	0.00	71.09	63.98
12-May	46.67	30.24	24.00	20.74	50.98	24.00	11.35	24.00	7.99	0.00	0.00	70.32	63.29
13-May	48.00	31.10	29.00	25.06	56.16	31.42	14.86	12.67	4.22	0.00	0.00	75.24	67.71
14-May	28.92	18.74	24.00	20.74	39.47	24.00	11.35	24.00	7.99	0.00	0.00	58.82	52.94
15-May	48.00	31.10	24.00	20.74	51.84	24.00	11.35	24.00	7.99	0.00	0.00	71.18	64.07
16-May	54.67	35.42	23.08	19.94	55.37	24.00	11.35	24.00	7.99	0.00	0.00	74.71	67.24
17-May	48.00	31.10	25.00	21.60	52.70	24.00	11.35	24.00	7.99	0.00	0.00	72.05	64.84
18-May	48.00	31.10	26.00	22.46	53.57	24.00	11.35	24.00	7.99	0.00	0.00	72.91	65.62
19-May	48.00	31.10	35.00	30.24	61.34	24.00	11.35	24.00	7.99	0.00	0.00	80.69	72.62
20-May	48.00	31.10	39.83	34.42	65.52	20.00	9.46	24.00	7.99	0.00	0.00	82.97	74.67
21-May	36.08	23.38	35.83	30.96	54.34	21.92	10.37	24.00	7.99	0.00	0.00	72.70	65.43
22-May	48.00	31.10	24.00	20.74	51.84	22.42	10.60	23.83	7.94	0.00	0.00	70.38	63.34
23-May	39.17	25.38	23.58	20.38	45.76	22.92	10.84	22.50	7.49	0.00	0.00	64.09	57.68
24-May	48.00	31.10	24.00	20.74	51.84	24.00	11.35	24.00	7.99	0.00	0.00	71.18	64.07
25-May	46.82	30.34	23.50	20.30	50.64	22.92	10.84	23.42	7.80	0.00	0.00	69.28	62.35
26-May	75.92	49.19	24.00	20.74	69.93	24.00	11.35	24.00	7.99	0.00	0.00	89.27	80.35
27-May	36.08	23.38	23.42	20.23	43.61	23.67	11.19	22.83	7.60	0.00	0.00	62.41	56.17
28-May	24.75	16.04	44.42	38.38	54.41	24.00	11.35	24.00	7.99	0.00	0.00	73.76	66.38
29-May	37.25	24.14	34.67	29.95	54.09	24.00	11.35	24.00	7.99	0.00	0.00	73.43	66.09
30-May	24.92	16.15	35.00	30.24	46.39	22.67	10.72	23.75	7.91	0.00	0.00	65.02	58.51
31-May	24.00	15.55	45.17	39.02	54.58	24.00	11.35	21.50	7.16	0.00	0.00	73.09	65.78
Total	**1266.32**	**820.57**	**891.75**	**770.47**	**1591.05**	**731.33**	**345.92**	**705.83**	**235.04**	**0.00**	**0.00**	**2172.01**	**1954.81**
Maximum												**89.27**	**80.35**
Minimum												**39.86**	**35.88**
Average		**26.47**		**24.85**	**51.32**		**11.16**		**7.58**		**0.00**	**70.06**	**63.06**

MONTH : June-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Jun	11.33	7.34	20.92	18.07	25.42	24.00	11.35	21.83	7.27	0.00	0.00	44.04	39.63
2-Jun	24.00	15.55	45.58	39.38	54.94	24.00	11.35	24.00	7.99	0.00	0.00	74.28	66.85
3-Jun	33.33	21.60	32.92	28.44	50.04	23.17	10.96	18.25	6.08	0.00	0.00	67.08	60.37
4-Jun	30.00	19.44	35.50	30.67	50.11	22.17	10.48	21.83	7.27	0.00	0.00	67.87	61.08
5-Jun	30.42	19.71	18.42	15.91	35.62	24.00	11.35	24.00	7.99	0.00	0.00	54.97	49.47
6-Jun	25.75	16.69	26.92	23.26	39.94	24.00	11.35	24.00	7.99	0.00	0.00	59.29	53.36
7-Jun	41.67	27.00	24.00	20.74	47.74	24.00	11.35	23.00	7.66	0.00	0.00	66.75	60.07
8-Jun	40.83	26.46	21.67	18.72	45.18	24.00	11.35	24.00	7.99	0.00	0.00	64.52	58.07
9-Jun	46.25	29.97	0.83	0.72	30.69	24.00	11.35	24.00	7.99	0.00	0.00	50.03	45.03
10-Jun	62.08	40.23	24.00	20.74	60.97	24.00	11.35	23.67	7.88	0.00	0.00	80.20	72.18
11-Jun	48.75	31.59	34.00	29.38	60.97	21.58	10.21	18.83	6.27	0.00	0.00	77.45	69.70
12-Jun	48.00	31.10	48.00	41.47	72.58	24.00	11.35	15.33	5.11	0.00	0.00	89.03	80.13
13-Jun	40.33	26.14	48.00	41.47	67.61	24.00	11.35	10.75	3.58	0.00	0.00	82.54	74.29
14-Jun	51.75	33.53	37.67	32.54	66.08	22.33	10.56	0.00	0.00	13.50	16.88	93.52	84.17
15-Jun	48.00	31.10	48.00	41.47	72.58	24.00	11.35	14.50	4.83	13.08	16.35	105.11	94.60
16-Jun	50.67	32.83	39.50	34.13	66.96	22.92	10.84	21.42	7.13	23.92	29.90	114.83	103.34
17-Jun	43.00	27.86	24.00	20.74	48.60	24.00	11.35	12.67	4.22	24.00	30.00	94.17	84.75
18-Jun	21.08	13.66	21.50	18.58	32.24	18.00	8.51	5.83	1.94	22.92	28.65	71.34	64.21
19-Jun	22.83	14.80	47.83	41.33	56.12	23.83	11.27	10.67	3.55	23.92	29.90	100.85	90.76
20-Jun	24.00	15.55	48.00	41.47	57.02	25.75	12.18	12.92	4.30	24.00	30.00	103.51	93.15
21-Jun	24.00	15.55	48.00	41.47	57.02	22.67	10.72	15.17	5.05	24.00	30.00	102.80	92.52
22-Jun	24.00	15.55	48.00	41.47	57.02	22.67	10.72	15.83	5.27	24.00	30.00	103.02	92.72
23-Jun	24.00	15.55	48.00	41.47	57.02	24.00	11.35	15.00	5.00	24.00	30.00	103.37	93.03
24-Jun	24.00	15.55	48.00	41.47	57.02	24.00	11.35	15.67	5.22	24.00	30.00	103.59	93.23
25-Jun	24.00	15.55	48.00	41.47	57.02	24.00	11.35	15.25	5.08	24.00	30.00	103.45	93.11
26-Jun	24.08	15.61	48.00	41.47	57.08	24.00	11.35	8.17	2.72	24.08	30.10	101.25	91.13
27-Jun	24.00	15.55	48.00	41.47	57.02	24.00	11.35	16.92	5.63	24.00	30.00	104.01	93.61
28-Jun	49.67	32.18	35.17	30.38	62.57	24.00	11.35	24.00	7.99	24.00	30.00	111.91	100.72
29-Jun	72.00	46.66	24.00	20.74	67.39	24.00	11.35	24.00	7.99	24.00	30.00	116.74	105.06
30-Jun	64.42	41.74	24.00	20.74	62.48	24.00	11.35	23.50	7.83	24.00	30.00	111.66	100.49
Total	**1098.25**	**711.67**	**1066.42**	**921.38**	**1633.05**	**705.08**	**333.50**	**525.00**	**174.83**	**385.42**	**481.77**	**2623.15**	**2360.84**
Maximum												**116.74**	**105.06**
Minimum												**44.04**	**39.63**
Average		**23.72**		**30.71**	**54.44**		**11.12**		**5.83**		**16.06**	**87.44**	**78.69**

Table M31.2.3 Flow Rate of Opa Water Treatment Plant in 2003 (4/6)

MONTH : July-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Jul	11.33	7.34	20.75	17.93	25.27	24.42	11.55	23.83	7.94	24.00	30.00	74.76	67.28
2-Jul	24.00	15.55	45.58	39.38	54.94	19.92	9.42	24.08	8.02	24.00	30.00	102.38	92.14
3-Jul	33.17	21.49	32.92	28.44	49.93	22.83	10.80	23.92	7.96	24.00	30.00	98.70	88.83
4-Jul	30.00	19.44	35.50	30.67	50.11	7.92	3.74	24.00	7.99	24.00	30.00	91.85	82.66
5-Jul	30.42	19.71	18.42	15.91	35.62	23.25	11.00	23.25	7.74	23.67	29.58	83.94	75.55
6-Jul	25.75	16.69	26.92	23.26	39.94	24.00	11.35	23.92	7.96	24.00	30.00	89.26	80.33
7-Jul	41.67	27.00	24.00	20.74	47.74	38.08	18.01	21.92	7.30	22.33	27.92	100.96	90.87
8-Jul	40.67	26.35	21.67	18.72	45.07	24.00	11.35	24.00	7.99	24.00	30.00	94.42	84.97
9-Jul	35.17	22.79	0.00	0.00	22.79	23.17	10.96	23.00	7.66	24.00	30.00	71.40	64.26
10-Jul	62.08	40.23	24.00	20.74	60.97	16.92	8.00	23.92	7.96	24.00	30.00	106.93	96.24
11-Jul	50.08	32.45	33.92	29.30	61.76	18.33	8.67	13.50	4.50	36.17	45.21	120.13	108.12
12-Jul	48.00	31.10	48.00	41.47	72.58	14.42	6.82	21.50	7.16	36.17	45.21	131.76	118.59
13-Jul	40.33	26.14	48.00	41.47	67.61	24.00	11.35	23.08	7.69	42.00	52.50	139.15	125.23
14-Jul	51.75	33.53	37.67	32.54	66.08	27.58	13.05	23.67	7.88	36.50	45.63	132.63	119.37
15-Jul	48.00	31.10	48.00	41.47	72.58	23.92	11.31	24.00	7.99	26.25	32.81	124.69	112.22
16-Jul	50.67	32.83	39.50	34.13	66.96	24.08	11.39	23.62	7.86	47.00	58.75	144.97	130.47
17-Jul	42.67	27.65	24.00	20.74	48.38	22.75	10.76	23.67	7.88	47.25	59.06	126.09	113.48
18-Jul	20.67	13.39	21.50	18.58	31.97	24.00	11.35	24.00	7.99	48.00	60.00	111.31	100.18
19-Jul	22.83	14.80	47.25	40.82	55.62	24.25	11.47	24.00	7.99	48.00	60.00	135.08	121.57
20-Jul	24.00	15.55	48.00	41.47	57.02	24.00	11.35	23.92	7.96	48.00	60.00	136.34	122.71
21-Jul	24.00	15.55	48.00	41.47	57.02	23.92	11.31	23.92	7.96	48.00	60.00	136.30	122.67
22-Jul	24.00	15.55	48.00	41.47	57.02	24.00	11.35	24.00	7.99	48.00	60.00	136.37	122.73
23-Jul	24.00	15.55	48.00	41.47	57.02	24.50	11.59	22.75	7.58	56.08	70.10	146.29	131.66
24-Jul	24.00	15.55	48.00	41.47	57.02	19.58	9.26	23.83	7.94	48.00	60.00	134.22	120.80
25-Jul	24.00	15.55	48.00	41.47	57.02	24.00	11.35	24.00	7.99	48.00	60.00	136.37	122.73
26-Jul	24.00	15.55	48.00	41.47	57.02	24.00	11.35	24.00	7.99	48.00	60.00	136.37	122.73
27-Jul	24.00	15.55	48.00	41.47	57.02	24.00	11.35	23.92	7.96	48.00	60.00	136.34	122.71
28-Jul	49.67	32.18	35.17	30.38	62.57	23.17	10.96	23.17	7.71	46.25	57.81	139.05	125.15
29-Jul	48.40	31.36	24.00	20.74	52.10	24.00	11.35	0.00	0.00	47.00	58.75	122.20	109.98
30-Jul	48.40	31.36	24.00	20.74	52.10	24.00	11.35	23.92	7.96	55.92	69.90	141.31	127.18
31-Jul	48.40	31.36	24.00	20.74	52.10	24.00	11.35	23.92	7.96	48.00	60.00	131.42	118.27
Total	**1096.12**	**710.28**	**1088.75**	**940.68**	**1650.96**	**711.00**	**336.30**	**698.20**	**232.50**	**1194.58**	**1493.23**	**3713.00**	**3341.70**
Maximum												**146.29**	**131.66**
Minimum												**71.40**	**64.26**
Average		**22.91**		**30.34**	**53.26**		**10.85**		**7.50**		**48.17**	**119.77**	**107.80**

MONTH : August-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Aug	48.00	31.10	31.75	27.43	58.54	24.00	11.35	24.00	7.99	48.00	60.00	137.88	124.09
2-Aug	48.00	31.10	44.08	38.09	69.19	24.00	11.35	24.00	7.99	24.15	30.19	118.72	106.85
3-Aug	60.42	39.15	24.00	20.74	59.89	20.00	9.46	21.50	7.16	48.50	60.63	137.13	123.42
4-Aug	51.50	33.37	32.08	27.72	61.09	24.83	11.75	23.75	7.91	52.75	65.94	146.68	132.02
5-Aug	57.25	37.10	24.00	20.74	57.83	23.83	11.27	17.50	5.83	25.17	31.46	106.39	95.75
6-Aug	24.00	15.55	48.00	41.47	57.02	24.00	11.35	23.92	7.96	41.67	52.08	128.42	115.58
7-Aug	34.75	22.52	48.00	41.47	63.99	24.00	11.35	23.92	7.96	48.00	60.00	143.31	128.98
8-Aug	50.17	32.51	27.33	23.62	56.12	24.00	11.35	24.00	7.99	48.00	60.00	135.47	121.92
9-Aug	70.53	45.71	23.83	20.59	66.30	24.00	11.35	24.00	7.99	47.92	59.90	145.54	130.98
10-Aug	72.00	46.66	24.00	20.74	67.39	24.00	11.35	20.17	6.72	48.00	60.00	145.46	130.91
11-Aug	42.75	27.70	16.92	14.62	42.32	24.00	11.35	24.00	7.99	48.00	60.00	121.66	109.50
12-Aug	22.25	14.42	24.00	20.74	35.15	24.00	11.35	24.00	7.99	48.00	60.00	114.50	103.05
13-Aug	14.67	9.50	32.25	27.86	37.37	24.25	11.47	15.67	5.22	39.17	48.96	103.01	92.71
14-Aug	23.00	14.90	38.92	33.62	48.53	22.50	10.64	19.25	6.41	45.67	57.08	122.66	110.40
15-Aug	32.08	20.79	24.00	20.74	41.53	28.08	13.28	3.58	1.19	48.25	60.31	116.32	104.68
16-Aug	16.07	10.41	23.83	20.59	31.00	44.00	20.81	0.00	0.00	48.00	60.00	111.82	100.63
17-Aug	18.08	11.72	29.08	25.13	36.85	45.67	21.60	0.00	0.00	45.25	56.56	115.01	103.51
18-Aug	11.58	7.51	32.75	28.30	35.80	44.00	20.81	0.00	0.00	48.00	60.00	116.61	104.95
19-Aug	24.00	15.55	24.00	20.74	36.29	46.50	21.99	0.00	0.00	48.00	60.00	118.28	106.45
20-Aug	2.50	1.62	29.17	25.20	26.82	43.00	20.34	0.00	0.00	48.00	60.00	107.16	96.44
21-Aug	0.00	0.00	48.00	41.47	41.47	46.00	21.76	0.00	0.00	48.00	60.00	123.23	110.91
22-Aug	0.00	0.00	48.00	41.47	41.47	46.33	21.92	0.00	0.00	24.00	30.00	93.39	84.05
23-Aug	8.17	5.29	30.08	25.99	31.28	41.33	19.55	0.00	0.00	34.75	43.44	94.27	84.84
24-Aug	24.00	15.55	24.00	20.74	36.29	36.00	17.03	10.25	3.41	48.00	60.00	116.73	105.06
25-Aug	24.00	15.55	24.00	20.74	36.29	36.42	17.23	11.17	3.72	48.00	60.00	117.23	105.51
26-Aug	24.00	15.55	24.00	20.74	36.29	44.00	20.81	4.83	1.61	48.00	60.00	118.71	106.84
27-Aug	24.00	15.55	24.00	20.74	36.29	34.42	16.28	9.83	3.27	48.00	60.00	115.84	104.26
28-Aug	24.00	15.55	24.00	20.74	36.29	31.25	14.78	22.25	7.41	45.92	57.40	115.87	104.29
29-Aug	22.17	14.36	23.83	20.59	34.96	34.75	16.44	14.08	4.69	45.58	56.98	113.06	101.76
30-Aug	30.92	20.03	20.42	17.64	37.67	26.42	12.50	23.58	7.85	47.42	59.27	117.29	105.56
31-Aug	34.08	22.09	13.92	12.02	34.11	23.17	10.96	13.67	4.55	45.33	56.67	106.29	95.66
Total	**938.93**	**608.43**	**906.25**	**783.00**	**1391.43**	**982.75**	**464.84**	**422.92**	**140.83**	**1381.48**	**1726.85**	**3723.95**	**3351.56**
Maximum												**146.68**	**132.02**
Minimum												**93.39**	**84.05**
Average		**19.63**		**25.26**	**44.88**		**14.99**		**4.54**		**55.70**	**120.13**	**108.11**

Table M31.2.3 Flow Rate of Opa Water Treatment Plant in 2003 (5/6)

MONTH : September-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	23.92	7.96	48.00	60.00	115.60	104.04
2-Sep	24.00	15.55	24.00	20.74	36.29	20.17	9.54	24.00	7.99	48.00	60.00	113.82	102.44
3-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	15.67	5.22	48.00	60.00	112.86	101.57
4-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	23.92	7.96	48.00	60.00	115.60	104.04
5-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	48.00	60.00	115.63	104.07
6-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	48.00	60.00	115.63	104.07
7-Sep	24.00	15.55	24.00	20.74	36.29	23.33	11.04	22.92	7.63	46.25	57.81	112.77	101.49
8-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	23.92	7.96	48.00	60.00	115.60	104.04
9-Sep	28.92	18.74	24.00	20.74	39.47	24.00	11.35	24.00	7.99	48.00	60.00	118.82	106.94
10-Sep	9.25	5.99	40.17	34.70	40.70	24.00	11.35	23.83	7.94	48.00	60.00	119.99	107.99
11-Sep	9.67	6.26	41.08	35.50	41.76	24.83	11.75	23.92	7.96	47.92	59.90	121.37	109.23
12-Sep	24.00	15.55	24.00	20.74	36.29	16.50	7.80	24.00	7.99	48.00	60.00	112.08	100.88
13-Sep	19.67	12.74	25.58	22.10	34.85	24.00	11.35	24.00	7.99	48.00	60.00	114.19	102.77
14-Sep	17.00	11.02	31.88	27.55	38.56	24.00	11.35	21.67	7.22	45.00	56.25	113.38	102.04
15-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	23.92	7.96	48.00	60.00	115.60	104.04
16-Sep	24.00	15.55	24.00	20.74	36.29	33.92	16.04	23.75	7.91	44.83	56.04	116.28	104.65
17-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	23.83	7.94	48.00	60.00	115.58	104.02
18-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	23.92	7.96	48.00	60.00	115.60	104.04
19-Sep	24.00	15.55	23.17	20.02	35.57	24.00	11.35	16.92	5.63	48.00	60.00	112.55	101.30
20-Sep	19.58	12.69	24.00	20.74	33.43	20.25	9.58	24.00	7.99	44.25	55.31	106.31	95.68
21-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	48.00	60.00	115.63	104.07
22-Sep	33.75	21.87	23.68	20.46	42.33	24.00	11.35	23.75	7.91	47.33	59.17	120.76	108.68
23-Sep	19.17	12.42	38.42	33.19	45.61	19.50	9.22	24.00	7.99	48.00	60.00	122.83	110.54
24-Sep	0.00	0.00	47.75	41.26	41.26	23.00	10.88	23.00	7.66	47.17	58.96	118.75	106.88
25-Sep	0.00	0.00	48.00	41.47	41.47	24.00	11.35	24.00	7.99	48.00	60.00	120.82	108.73
26-Sep	13.83	8.96	31.08	26.86	35.82	24.00	11.35	23.92	7.96	48.00	60.00	115.14	103.62
27-Sep	27.67	17.93	20.42	17.64	35.57	24.00	11.35	24.00	7.99	47.83	59.79	114.70	103.23
28-Sep	26.83	17.39	24.00	20.74	38.12	24.00	11.35	16.42	5.47	42.67	53.33	108.28	97.45
29-Sep	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	48.00	60.00	115.63	104.07
30-Sep	24.00	15.55	24.00	20.74	36.29	21.42	10.13	24.00	7.99	48.00	60.00	114.41	102.97
Total	**633.33**	**410.40**	**827.23**	**714.73**	**1125.13**	**706.92**	**334.37**	**691.17**	**230.16**	**1421.25**	**1776.56**	**3466.22**	**3119.60**
Maximum												**122.83**	**110.54**
Minimum												**106.31**	**95.68**
Average		**13.68**		**23.82**	**37.50**		**11.15**		**7.67**		**59.22**	**115.54**	**103.99**

MONTH : October-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Oct	24.00	15.55	24.00	20.74	36.29	22.00	10.41	23.92	7.96	48.00	60.00	114.66	103.19
2-Oct	23.83	15.44	23.83	20.59	36.04	23.00	10.88	23.50	7.83	47.08	58.85	113.59	102.24
3-Oct	23.67	15.34	23.00	19.87	35.21	22.00	10.41	22.58	7.52	32.25	40.31	93.45	84.10
4-Oct	23.00	14.90	23.00	19.87	34.78	24.00	11.35	24.50	8.16	61.00	76.25	130.54	117.48
5-Oct	24.00	15.55	24.00	20.74	36.29	24.00	11.35	22.42	7.46	48.00	60.00	115.10	103.59
6-Oct	33.33	21.60	19.33	16.70	38.30	13.00	6.15	24.00	7.99	45.67	57.08	109.53	98.58
7-Oct	22.08	14.31	24.00	20.74	35.05	20.00	9.46	21.08	7.02	48.00	60.00	111.53	100.37
8-Oct	27.50	17.82	24.00	20.74	38.56	24.00	11.35	24.00	7.99	48.00	60.00	117.90	106.11
9-Oct	30.08	19.49	24.00	20.74	40.23	24.00	11.35	23.92	7.96	48.00	60.00	119.55	107.59
10-Oct	40.83	26.46	21.42	18.50	44.96	24.00	11.35	24.00	7.99	48.00	60.00	124.31	111.88
11-Oct	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	48.00	60.00	115.63	104.07
12-Oct	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	48.00	60.00	115.63	104.07
13-Oct	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	48.00	60.00	115.63	104.07
14-Oct	20.08	13.01	24.00	20.74	33.75	24.00	11.35	23.92	7.96	48.00	60.00	113.07	101.76
15-Oct	22.75	14.74	22.17	19.15	33.89	22.67	10.72	24.00	7.99	42.33	52.92	105.52	94.97
16-Oct	48.00	31.10	24.00	20.74	51.84	28.00	13.24	16.00	5.33	41.92	52.40	122.81	110.53
17-Oct	28.83	18.68	24.00	20.74	39.42	24.00	11.35	10.67	3.55	48.00	60.00	114.32	102.89
18-Oct	28.17	18.25	24.00	20.74	38.99	24.00	11.35	24.00	7.99	48.00	60.00	118.33	106.50
19-Oct	24.00	15.55	24.00	20.74	36.29	24.00	11.35	23.92	7.96	48.00	60.00	115.60	104.04
20-Oct	25.33	16.42	24.00	20.74	37.15	24.17	11.43	22.00	7.33	48.00	60.00	115.91	104.32
21-Oct	21.92	14.20	22.17	19.15	33.35	24.00	11.35	23.58	7.85	47.50	59.38	111.93	100.74
22-Oct	16.50	10.69	22.75	19.66	30.35	27.33	12.93	21.58	7.19	47.08	58.85	109.32	98.39
23-Oct	38.00	24.62	34.50	29.81	54.43	24.00	11.35	23.83	7.94	35.12	43.90	117.62	105.85
24-Oct	54.50	35.32	28.42	24.55	59.87	26.17	12.38	21.00	6.99	23.83	29.79	109.03	98.13
25-Oct	48.00	31.10	24.00	20.74	51.84	26.17	12.38	23.92	7.96	24.00	30.00	102.18	91.96
26-Oct	48.00	31.10	24.00	20.74	51.84	24.00	11.35	24.00	7.99	24.00	30.00	101.18	91.07
27-Oct	36.08	23.38	24.00	20.74	44.12	24.00	11.35	24.00	7.99	35.75	44.69	108.15	97.33
28-Oct	21.50	13.93	24.00	20.74	34.67	18.00	8.51	24.00	7.99	48.00	60.00	111.17	100.06
29-Oct	13.17	8.53	16.25	14.04	22.57	30.17	14.27	21.17	7.05	33.08	41.35	85.24	76.72
30-Oct	24.00	15.55	24.08	20.81	36.36	26.83	12.69	24.00	7.99	48.00	60.00	117.04	105.34
31-Oct	24.00	15.55	24.00	20.74	36.29	24.00	11.35	24.00	7.99	48.00	60.00	115.63	104.07
Total	**887.17**	**574.88**	**736.92**	**636.70**	**1211.58**	**737.50**	**348.84**	**705.50**	**234.93**	**1356.62**	**1695.77**	**3491.12**	**3142.01**
Maximum												**130.54**	**117.48**
Minimum												**85.24**	**76.72**
Average		**18.54**		**20.54**	**39.08**		**11.25**		**7.58**		**54.70**	**112.62**	**101.36**

Table M31.2.3 Flow Rate of Opa Water Treatment Plant in 2003 (6/6)

MONTH : November-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Nov	38.50	24.95	24.00	20.74	45.68	24.00	11.35	24.00	7.99	46.00	57.50	122.53	110.28
2-Nov	38.50	24.95	24.00	20.74	45.68	22.00	10.41	23.25	7.74	44.75	55.94	119.77	107.79
3-Nov	50.00	32.40	24.00	20.74	53.14	5.33	2.52	24.00	7.99	30.92	38.65	102.30	92.07
4-Nov	35.67	23.11	24.00	20.74	43.85	24.00	11.35	24.00	7.99	48.00	60.00	123.19	110.87
5-Nov	24.00	15.55	38.33	33.12	48.67	26.17	12.38	22.58	7.52	38.08	47.60	116.17	104.56
6-Nov	34.50	22.36	24.67	21.31	43.67	41.50	19.63	24.00	7.99	24.42	30.52	101.81	91.63
7-Nov	43.58	28.24	24.00	20.74	48.98	38.33	18.13	6.92	2.30	41.92	52.40	121.81	109.63
8-Nov	31.42	20.36	28.67	24.77	45.13	38.25	18.09	8.50	2.83	42.58	53.23	119.28	107.35
9-Nov	32.75	21.22	38.00	32.83	54.05	24.00	11.35	24.00	7.99	48.00	60.00	133.40	120.06
10-Nov	26.50	17.17	24.00	20.74	37.91	24.00	11.35	23.92	7.96	48.00	60.00	117.22	105.50
11-Nov	23.08	14.96	39.00	33.70	48.65	26.75	12.65	24.00	7.99	48.00	60.00	129.30	116.37
12-Nov	24.17	15.66	28.42	24.55	40.21	24.00	11.35	24.00	7.99	48.00	60.00	119.56	107.60
13-Nov	10.25	6.64	44.33	38.30	44.95	24.00	11.35	24.00	7.99	48.00	60.00	124.29	111.86
14-Nov	37.17	24.08	24.00	20.74	44.82	24.00	11.35	23.58	7.85	48.00	60.00	124.03	111.62
15-Nov	23.00	14.90	41.00	35.42	50.33	24.00	11.35	24.00	7.99	48.00	60.00	129.67	116.70
16-Nov	23.08	14.96	24.00	20.74	35.69	24.00	11.35	24.00	7.99	48.00	60.00	115.04	103.53
17-Nov	31.50	20.41	17.00	14.69	35.10	24.00	11.35	23.92	7.96	48.00	60.00	114.42	102.97
18-Nov	36.33	23.54	28.75	24.84	48.38	24.17	11.43	19.75	6.58	47.42	59.27	125.66	113.10
19-Nov	36.17	23.44	24.00	20.74	44.17	17.75	8.40	24.00	7.99	48.00	60.00	120.56	108.50
20-Nov	37.17	24.08	25.83	22.32	46.40	24.50	11.59	7.58	2.53	47.50	59.38	119.89	107.90
21-Nov	42.17	27.32	23.92	20.66	47.99	25.33	11.98	24.00	7.99	47.58	59.48	127.44	114.70
22-Nov	48.00	31.10	24.00	20.74	51.84	24.33	11.51	24.00	7.99	48.00	60.00	131.34	118.21
23-Nov	39.08	25.33	24.00	20.74	46.06	24.00	11.35	24.00	7.99	48.00	60.00	125.41	112.87
24-Nov	44.58	28.89	35.08	30.31	59.20	18.00	8.51	23.92	7.96	48.00	60.00	135.68	122.11
25-Nov	28.17	18.25	30.92	26.71	44.96	19.33	9.14	24.00	7.99	48.00	60.00	122.10	109.89
26-Nov	48.00	31.10	24.00	20.74	51.84	26.00	12.30	24.00	7.99	48.00	60.00	132.13	118.92
27-Nov	52.75	34.18	21.00	18.14	52.33	24.00	11.35	24.00	7.99	42.83	53.54	125.21	112.69
28-Nov	48.00	31.10	24.00	20.74	51.84	13.00	6.15	24.00	7.99	48.00	60.00	125.98	113.38
29-Nov	48.00	31.10	24.00	20.74	51.84	22.25	10.52	24.00	7.99	48.00	60.00	130.36	117.32
30-Nov	45.08	29.21	24.00	20.74	49.95	22.00	10.41	24.00	7.99	48.00	60.00	128.35	115.51
Total	**1081.17**	**700.60**	**824.92**	**712.73**	**1413.32**	**723.00**	**341.98**	**663.92**	**221.08**	**1366.00**	**1707.50**	**3683.89**	**3315.50**
Maximum												**135.68**	**122.11**
Minimum												**101.81**	**91.63**
Average		**23.35**		**23.76**	**47.11**		**11.40**		**7.37**		**56.92**	**122.80**	**110.52**

MONTH : December-03

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Dec	43.75	28.35	24.00	20.74	49.09	24.00	11.35	23.92	7.96	48.00	60.00	128.40	115.56
2-Dec	46.08	29.86	22.83	19.73	49.59	23.00	10.88	23.75	7.91	47.25	59.06	127.44	114.70
3-Dec	42.67	27.65	24.00	20.74	48.38	20.17	9.54	24.00	7.99	48.00	60.00	125.91	113.32
4-Dec	43.58	28.24	24.00	20.74	48.98	16.17	7.65	24.00	7.99	48.00	60.00	124.62	112.16
5-Dec	41.92	27.16	24.00	20.74	47.90	23.92	11.31	24.00	7.99	48.00	60.00	127.20	114.48
6-Dec	34.75	22.52	32.42	28.01	50.53	26.17	12.38	23.00	7.66	42.00	52.50	123.06	110.76
7-Dec	36.15	23.43	39.42	34.06	57.48	22.50	10.64	9.67	3.22	9.00	11.25	82.59	74.33
8-Dec	46.33	30.02	29.50	25.49	55.51	23.33	11.04	23.75	7.91	39.17	48.96	123.42	111.07
9-Dec	47.17	30.56	24.00	20.74	51.30	24.00	11.35	24.00	7.99	47.25	59.06	129.71	116.74
10-Dec	23.92	15.50	35.83	30.96	46.46	28.08	13.28	20.92	6.97	48.00	60.00	126.71	114.04
11-Dec	42.33	27.43	26.08	22.54	49.97	23.42	11.08	23.92	7.96	46.83	58.54	127.55	114.80
12-Dec	43.92	28.46	24.00	20.74	49.19	24.00	11.35	24.00	7.99	43.75	54.69	123.23	110.90
13-Dec	30.00	19.44	29.17	25.20	44.64	24.00	11.35	24.00	7.99	48.00	60.00	123.98	111.59
14-Dec	35.17	22.79	17.75	15.34	38.12	24.00	11.35	24.00	7.99	48.00	60.00	117.47	105.72
15-Dec	31.67	20.52	31.75	27.43	47.95	23.00	10.88	24.00	7.99	48.00	60.00	126.82	114.14
16-Dec	40.67	26.35	24.00	20.74	47.09	23.92	11.31	24.00	7.99	48.00	60.00	126.39	113.75
17-Dec	29.08	18.85	32.00	27.65	46.49	20.08	9.50	21.58	7.19	48.00	60.00	123.18	110.86
18-Dec	23.08	14.96	28.33	24.48	39.44	23.67	11.19	23.92	7.96	48.00	60.00	118.60	106.74
19-Dec	31.83	20.63	28.75	24.84	45.47	24.17	11.43	24.00	7.99	48.00	60.00	124.89	112.40
20-Dec	24.00	15.55	48.00	41.47	57.02	24.00	11.35	24.00	7.99	48.00	60.00	136.37	122.73
21-Dec	24.00	15.55	48.00	41.47	57.02	24.00	11.35	24.00	7.99	48.00	60.00	136.37	122.73
22-Dec	24.00	15.55	48.00	41.47	57.02	22.08	10.45	23.92	7.96	48.00	60.00	135.43	121.89
23-Dec	37.17	24.08	48.00	41.47	65.56	17.00	8.04	24.00	7.99	34.75	43.44	125.03	112.52
24-Dec	59.67	38.66	24.83	21.46	60.12	23.83	11.27	16.58	5.52	36.83	46.04	122.96	110.66
25-Dec	37.92	24.57	24.00	20.74	45.31	24.00	11.35	24.00	7.99	48.00	60.00	124.65	112.19
26-Dec	29.33	19.01	35.00	30.24	49.25	23.00	10.88	24.00	7.99	48.00	60.00	128.12	115.31
27-Dec	23.00	14.90	24.00	20.74	35.64	24.00	11.35	24.00	7.99	48.00	60.00	114.98	103.49
28-Dec	33.17	21.49	16.38	14.16	35.65	29.58	13.99	22.75	7.58	46.00	57.50	114.72	103.24
29-Dec	39.92	25.87	20.83	18.00	43.87	24.08	11.39	24.00	7.99	48.00	60.00	123.25	110.92
30-Dec	28.33	18.36	37.33	32.26	50.62	24.00	11.35	23.92	7.96	48.00	60.00	129.93	116.94
31-Dec	44.75	29.00	24.00	20.74	49.73	24.00	11.35	24.00	7.99	48.00	60.00	129.08	116.17
Total	**1119.32**	**725.32**	**920.22**	**795.07**	**1520.38**	**725.17**	**343.00**	**713.58**	**237.62**	**1400.83**	**1751.04**	**3852.05**	**3466.85**
Maximum												**136.37**	**122.73**
Minimum												**82.59**	**74.33**
Average		**23.40**		**25.65**	**49.04**		**11.06**		**7.67**		**56.49**	**124.26**	**111.83**

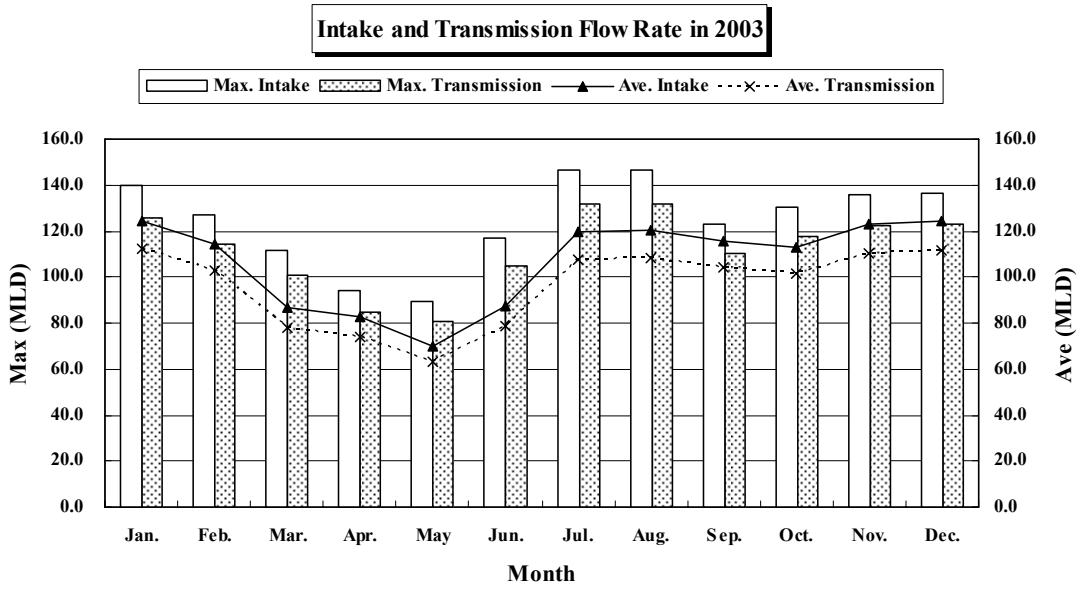

Figure M31.2.2 Flow Rate of Opa Water Treatment Plant in 2003

Table M31.2.4 Flow Rate of Opa Water Treatment Plant in 2004 (1/5)

MONTH : Jan-04

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Jan	44.33	28.73	21.50	18.58	47.30	24.00	11.35	23.92	7.96	48.00	60.00	126.62	113.96
2-Jan	39.08	25.33	27.25	23.54	48.87	23.92	11.31	24.00	7.99	44.25	55.31	123.49	111.14
3-Jan	15.92	10.31	48.00	41.47	51.79	24.00	11.35	24.00	7.99	46.83	58.54	129.67	116.70
4-Jan	41.17	26.68	26.08	22.54	49.21	24.00	11.35	24.00	7.99	48.00	60.00	128.56	115.70
5-Jan	48.00	31.10	19.25	16.63	47.74	24.00	11.35	24.00	7.99	48.00	60.00	127.08	114.37
6-Jan	42.33	27.43	24.00	20.74	48.17	37.50	17.74	23.92	7.96	48.00	60.00	133.87	120.48
7-Jan	43.83	28.40	24.00	20.74	49.14	21.33	10.09	36.33	12.10	48.00	60.00	131.33	118.20
8-Jan	35.17	22.79	30.67	26.50	49.28	13.08	6.19	19.92	6.63	47.42	59.27	121.38	109.24
9-Jan	38.50	24.95	24.00	20.74	45.68	44.00	20.81	35.25	11.74	48.00	60.00	138.23	124.41
10-Jan	48.00	31.10	24.00	20.74	51.84	23.67	11.19	11.50	3.83	48.00	60.00	126.86	114.18
11-Jan	27.92	18.09	34.00	29.38	47.47	24.00	11.35	12.25	4.08	47.42	59.27	122.17	109.95
12-Jan	37.83	24.52	28.87	24.94	49.46	24.00	11.35	24.00	7.99	48.00	60.00	128.80	115.92
13-Jan	21.50	13.93	36.83	31.82	45.76	24.00	11.35	24.00	7.99	48.00	60.00	125.10	112.59
14-Jan	43.33	28.08	21.08	18.22	46.30	13.17	6.23	37.25	12.40	47.33	59.17	124.09	111.69
15-Jan	46.58	30.19	22.50	19.44	49.63	13.33	6.31	34.50	11.49	47.92	59.90	127.32	114.59
16-Jan	40.08	25.97	24.00	20.74	46.71	32.25	15.25	10.50	3.50	48.00	60.00	125.46	112.91
17-Jan	36.00	23.33	24.00	20.74	44.06	24.00	11.35	25.17	8.38	48.00	60.00	123.80	111.42
18-Jan	28.92	18.74	20.58	17.78	36.52	2.00	0.95	37.00	12.32	48.00	60.00	109.79	98.81
19-Jan	28.83	18.68	33.83	29.23	47.92	36.08	17.07	0.00	0.00	48.00	60.00	124.98	112.49
20-Jan	27.92	18.09	36.60	31.62	49.71	36.42	17.23	2.25	0.75	47.17	58.96	126.65	113.98
21-Jan	32.67	21.17	32.92	28.44	49.61	1.83	0.87	23.67	7.88	48.00	60.00	118.36	106.52
22-Jan	43.92	28.46	24.00	20.74	49.19	24.00	11.35	24.00	7.99	47.92	59.90	128.43	115.59
23-Jan	33.08	21.44	43.00	37.15	58.59	41.00	19.39	10.50	3.50	48.00	60.00	141.48	127.33
24-Jan	40.42	26.19	24.00	20.74	46.93	41.58	19.67	13.50	4.50	48.00	60.00	131.09	117.98
25-Jan	28.17	18.25	35.83	30.96	49.21	15.83	7.49	24.00	7.99	48.00	60.00	124.69	112.22
26-Jan	26.58	17.23	25.08	21.67	38.90	17.92	8.47	24.00	7.99	48.00	60.00	115.36	103.83
27-Jan	24.08	15.61	41.00	35.42	51.03	45.92	21.72	10.50	3.50	36.00	45.00	121.25	109.12
28-Jan	40.50	26.24	23.67	20.45	46.69	35.50	16.79	1.00	0.33	32.20	40.25	104.07	93.66
29-Jan	67.00	43.42	24.12	20.84	64.25	8.08	3.82	0.00	0.00	57.67	72.08	140.16	126.14
30-Jan	55.83	36.18	24.00	20.74	56.92	15.67	7.41	0.00	0.00	48.00	60.00	124.33	111.89
31-Jan	54.17	35.10	21.50	18.58	53.68	23.83	11.27	8.42	2.80	48.00	60.00	127.75	114.98
Total	**1181.67**	**765.72**	**870.17**	**751.82**	**1517.54**	**759.92**	**359.44**	**593.33**	**197.58**	**1462.12**	**1827.65**	**3902.21**	**3511.99**
Average		**24.70**		**24.25**	**48.95**		**11.59**		**6.37**		**58.96**	**125.88**	**113.29**

Average raw water pumped per day : **4.06 MLD**

Average clear water pumped per day : **113.29 MLD**

MONTH : Feb-04

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr			473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Feb	28.42	18.41	17.50	15.12	33.53	24.00	11.35	24.00	7.99	51.50	64.38	117.25	105.53
2-Feb	8.17	5.29	48.00	41.47	46.76	24.00	11.35	24.00	7.99	48.00	60.00	126.11	113.50
3-Feb	32.25	20.90	25.50	22.03	42.93	15.33	7.25	13.33	4.44	55.67	69.58	124.21	111.79
4-Feb	47.50	30.78	18.92	16.34	47.12	23.92	11.31	18.00	5.99	48.00	60.00	124.43	111.99
5-Feb	49.00	31.75	31.00	26.78	58.54	23.42	11.08	20.00	6.66	32.83	41.04	117.31	105.58
6-Feb	24.00	15.55	45.00	38.88	54.43	38.42	18.17	24.00	7.99	48.00	60.00	140.60	126.54
7-Feb	29.33	19.01	33.00	28.51	47.52	32.92	15.57	24.00	7.99	48.00	60.00	131.08	117.97
8-Feb	24.00	15.55	26.08	22.54	38.09	10.58	5.01	24.00	7.99	48.00	60.00	111.09	99.98
9-Feb	16.92	10.96	26.50	22.90	33.86	9.42	4.45	13.17	4.38	48.00	60.00	102.70	92.43
10-Feb	28.42	18.41	22.75	19.66	38.07	31.08	14.70	0.42	0.14	56.75	70.94	123.85	111.46
11-Feb	23.08	14.96	34.08	29.45	44.41	11.58	5.48	24.00	7.99	37.25	46.56	104.44	94.00
12-Feb	15.17	9.83	28.08	24.26	34.09	42.33	20.02	24.00	7.99	45.00	56.25	118.36	106.52
13-Feb	32.00	20.74	34.42	29.74	50.47	24.00	11.35	23.50	7.83	42.75	53.44	123.09	110.78
14-Feb	38.00	24.62	34.58	29.88	54.50	24.00	11.35	24.00	7.99	46.75	58.44	132.29	119.06
15-Feb	34.92	22.63	24.00	20.74	43.36	24.00	11.35	24.00	7.99	48.00	60.00	122.71	110.44
16-Feb	28.58	18.52	19.17	16.56	35.08	24.00	11.35	24.00	7.99	48.00	60.00	114.43	102.98
17-Feb	48.00	31.10	19.92	17.21	48.31	24.00	11.35	24.00	7.99	47.92	59.90	127.55	114.80
18-Feb	36.50	23.65	32.08	27.72	51.37	24.00	11.35	24.00	7.99	48.00	60.00	130.72	117.64
19-Feb	48.00	31.10	24.00	20.74	51.84	24.00	11.35	22.17	7.38	48.00	60.00	130.57	117.52
20-Feb	48.00	31.10	24.00	20.74	51.84	0.00	0.00	24.00	7.99	48.00	60.00	119.83	107.85
21-Feb	36.92	23.92	20.33	17.57	41.49	0.00	0.00	23.25	7.74	48.17	60.21	109.44	98.50
22-Feb	19.83	12.85	12.50	10.80	23.65	0.00	0.00	24.00	7.99	48.00	60.00	91.64	82.48
23-Feb	34.17	22.14	47.58	41.11	63.25	0.00	0.00	32.25	10.74	46.92	58.65	132.64	119.37
24-Feb	48.00	31.10	30.67	26.50	57.60	0.00	0.00	24.00	7.99	40.83	51.04	116.63	104.97
25-Feb	36.50	23.65	24.83	21.46	45.11	24.00	11.35	24.00	7.99	38.83	48.54	112.99	101.69
26-Feb	37.17	24.08	34.00	29.38	53.46	24.75	11.71	10.58	3.52	46.50	58.13	126.82	114.13
27-Feb	24.83	16.09	22.58	19.51	35.60	14.25	6.74	12.92	4.30	48.00	60.00	106.65	95.98
28-Feb	27.42	17.77	37.25	32.18	49.95	13.58	6.42	14.42	4.80	47.17	58.96	120.13	108.12
29-Feb	27.42	17.77	38.33	33.12	50.89	16.25	7.69	18.50	6.16	43.75	54.69	119.42	107.48
Total	**932.50**	**604.26**	**836.67**	**722.88**	**1327.14**	**547.83**	**259.13**	**606.50**	**201.96**	**1352.58**	**1690.73**	**3478.96**	**3131.06**
Average		**20.84**		**24.93**	**45.76**		**8.94**		**6.96**		**58.30**	**119.96**	**107.97**

Average raw water pumped per day : **119.96 MLD**

Average clear water pumped per day : **107.97 MLD**

Table M31.2.4 Flow Rate of Opa Water Treatment Plant in 2004 (2/5)

MONTH : March-04

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Mar	31.83	20.63	35.08	30.31	50.94	17.92	8.47	15.00	5.00	39.83	49.79	114.20	102.78
2-Mar	48.00	31.10	24.00	20.74	51.84	24.00	11.35	24.00	7.99	24.00	30.00	101.18	91.07
3-Mar	66.08	42.82	29.08	25.13	67.95	24.00	11.35	24.00	7.99	24.00	30.00	117.29	105.56
4-Mar	55.17	35.75	28.00	24.19	59.94	19.50	9.22	19.28	6.42	24.08	30.10	105.69	95.12
5-Mar	48.75	31.59	31.50	27.22	58.81	23.83	11.27	23.75	7.91	23.75	29.69	107.68	96.91
6-Mar	64.50	41.80	32.75	28.30	70.09	15.17	7.17	24.00	7.99	24.00	30.00	115.26	103.73
7-Mar	48.00	31.10	38.17	32.98	64.08	14.50	6.86	24.00	7.99	24.00	30.00	108.93	98.04
8-Mar	56.83	36.83	24.00	20.74	57.56	22.08	10.45	22.42	7.46	24.00	30.00	105.47	94.93
9-Mar	72.00	46.66	13.83	11.95	58.61	24.00	11.35	22.50	7.49	24.00	30.00	107.45	96.71
10-Mar	63.42	41.09	25.92	22.39	63.49	26.83	12.69	24.00	7.99	24.00	30.00	114.17	102.75
11-Mar	48.00	31.10	38.17	32.98	64.08	22.67	10.72	24.00	7.99	24.00	30.00	112.79	101.51
12-Mar	29.08	18.85	0.00	0.00	18.85	0.00	0.00			0.00	0.00	18.85	16.96
13-Mar	41.17	26.68	21.75	18.79	45.47	19.00	8.99	18.67	6.22	47.17	58.96	119.63	107.67
14-Mar	30.58	19.82	23.75	20.52	40.34	8.42	3.98	5.17	1.72	45.33	56.67	102.71	92.44
15-Mar	24.00	15.55	39.67	34.27	49.82	16.83	7.96	5.17	1.72	48.00	60.00	119.51	107.56
16-Mar	29.58	19.17	24.00	20.74	39.91	13.92	6.58	0.00	0.00	48.00	60.00	106.49	95.84
17-Mar	47.25	30.62	14.33	12.38	43.00	4.42	2.09	9.50	3.16	48.00	60.00	108.25	97.43
18-Mar	49.08	31.81	21.58	18.65	50.45	9.25	4.38	22.08	7.35	30.08	37.60	99.79	89.81
19-Mar	48.42	31.37	23.33	20.16	51.53	0.00	0.00	0.00	0.00	0.00	0.00	51.53	46.38
20-Mar	63.42	41.09	17.83	15.41	56.50	23.92	11.31	4.83	1.61	37.17	46.46	115.88	104.29
21-Mar	72.00	46.66	24.00	20.74	67.39	24.00	11.35	24.00	7.99	24.00	30.00	116.74	105.06
22-Mar	52.33	33.91	37.17	32.11	66.02	26.33	12.46	18.08	6.02	24.00	30.00	114.50	103.05
23-Mar	50.17	32.51	41.17	35.57	68.08	39.67	18.76	24.00	7.99	24.00	30.00	124.83	112.35
24-Mar	66.33	42.98	24.00	20.74	63.72	35.58	16.83	24.00	7.99	24.00	30.00	118.54	106.69
25-Mar	72.00	46.66	24.00	20.74	67.39	31.42	14.86	24.00	7.99	24.00	30.00	120.24	108.22
26-Mar	72.00	46.66	0.25	0.22	46.87	40.42	19.12	24.00	7.99	24.00	30.00	103.98	93.58
27-Mar	72.00	46.66	24.00	20.74	67.39	30.25	14.31	21.75	7.24	24.00	30.00	118.94	107.05
28-Mar	72.50	46.98	15.42	13.32	60.30	28.58	13.52	24.00	7.99	24.00	30.00	111.81	100.63
29-Mar	83.17	53.89	12.75	11.02	64.91	31.58	14.94	24.00	7.99	24.00	30.00	117.84	106.06
30-Mar	72.00	46.66	26.17	22.61	69.26	35.67	16.87	24.00	7.99	23.83	29.79	123.92	111.53
31-Mar	43.33	28.08	48.00	41.47	69.55	30.83	14.58	24.00	7.99	24.00	30.00	122.13	109.92
Total	**1693.00**	**1097.06**	**783.67**	**677.09**	**1774.15**	**684.58**	**323.81**	**568.20**	**189.21**	**847.25**	**1059.06**	**3346.23**	**3011.61**
Average		**35.39**		**21.84**	**57.23**		**10.45**		**6.31**		**34.16**	**107.94**	**97.15**

Average raw water pumped per day : **107.94 MLD**

Average clear water pumped per day : **97.15 MLD**

MONTH : April-04

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Apr	48.00	31.10	48.00	41.47	72.58	12.50	5.91	24.00	7.99	20.99	26.24	112.72	101.45
2-Apr	48.00	31.10	48.00	41.47	72.58	19.67	9.30	24.00	7.99	28.21	35.27	125.14	112.62
3-Apr	60.83	39.42	34.33	29.66	69.08	24.75	11.71	23.25	7.74	33.07	41.34	129.88	116.89
4-Apr	72.00	46.66	21.00	18.14	64.80	24.00	11.35	15.08	5.02	29.46	36.83	118.00	106.20
5-Apr	70.25	45.52	25.47	22.00	67.53	24.00	11.35	22.92	7.63	32.20	40.25	126.76	114.09
6-Apr	51.42	33.32	37.08	32.04	65.36	24.00	11.35	22.92	7.63	32.20	40.25	124.59	112.13
7-Apr	41.17	26.68	46.05	39.79	66.46	24.00	11.35	24.00	7.99	32.58	40.73	126.53	113.88
8-Apr	41.42	26.84	48.00	41.47	68.31	22.17	10.48	24.00	7.99	30.73	38.42	125.20	112.68
9-Apr	44.50	28.84	48.00	41.47	70.31	24.00	11.35	23.00	7.66	32.23	40.29	129.61	116.65
10-Apr	31.00	20.09	36.83	31.82	51.91	24.00	11.35	22.83	7.60	32.17	40.22	111.08	99.98
11-Apr	31.17	20.20	28.17	24.34	44.53	23.83	11.27	0.00	0.00	24.02	30.03	85.83	77.25
12-Apr	47.58	30.83	23.83	20.59	51.43	23.83	11.27	0.00	0.00	24.02	30.03	92.73	83.45
13-Apr	46.00	29.81	24.00	20.74	50.54	22.00	10.41	0.00	0.00	22.17	27.72	88.67	79.80
14-Apr	36.00	23.33	32.08	27.72	51.05	22.00	10.41	8.17	2.72	25.03	31.29	95.46	85.91
15-Apr	58.58	37.96	23.33	20.16	58.12	23.83	11.27	2.00	0.67	24.72	30.90	100.96	90.87
16-Apr	61.08	39.58	34.83	30.10	69.68	24.00	11.35	14.83	4.94	29.38	36.72	122.69	110.42
17-Apr	43.83	28.40	43.83	37.87	66.28	19.42	9.18	22.00	7.33	27.26	34.08	116.86	105.18
18-Apr	39.50	25.60	35.17	30.38	55.98	21.08	9.97	1.83	0.61	21.89	27.36	93.93	84.53
19-Apr	47.25	30.62	23.92	20.66	51.28	23.83	11.27	0.00	0.00	24.02	30.03	92.58	83.32
20-Apr	46.50	30.13	23.50	20.30	50.44	23.50	11.12	0.00	0.00	23.69	29.61	91.16	82.04
21-Apr	53.73	34.82	22.88	19.77	54.59	23.08	10.92	1.75	0.58	23.88	29.85	95.94	86.34
22-Apr	43.92	28.46	24.00	20.74	49.19	24.00	11.35	14.33	4.77	29.20	36.50	101.82	91.64
23-Apr	52.33	33.91	24.00	20.74	54.65	24.00	11.35	3.33	1.11	25.35	31.69	98.80	88.92
24-Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25-Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26-Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27-Apr	50.42	32.67	24.00	20.74	53.41	17.92	8.47	10.33	3.44	21.67	27.09	92.41	83.17
28-Apr	48.58	31.48	24.00	20.74	52.22	20.42	9.66	4.58	1.53	22.18	27.73	91.13	82.01
29-Apr	45.50	29.48	23.08	19.94	49.43	17.25	8.16	11.92	3.97	21.55	26.94	88.50	79.65
30-Apr	42.17	27.32	24.00	20.74	48.06	24.00	11.35	12.75	4.25	28.65	35.81	99.47	89.52
Total	**1302.73**	**844.17**	**851.40**	**735.61**	**1579.78**	**601.08**	**284.31**	**333.83**	**111.17**	**722.55**	**903.19**	**2878.45**	**2590.61**
Average		**28.14**		**24.52**	**52.66**		**9.48**		**3.71**		**30.11**	**95.95**	**86.35**

Average raw water pumped per day : **95.95 MLD**

Average clear water pumped per day : **86.35 MLD**

Table M31.2.4 Flow Rate of Opa Water Treatment Plant in 2004 (3/5)

MONTH : May-04

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-May	33.58	21.76	15.25	13.18	34.94	12.33	5.83	10.08	3.36	47.67	59.58	103.71	93.34
2-May	38.00	24.62	33.08	28.58	53.21	18.00	8.51	9.17	3.05	48.00	60.00	124.77	112.30
3-May	46.42	30.08	31.83	27.50	57.58	20.00	9.46	1.25	0.42	47.17	58.96	126.42	113.77
4-May	18.42	11.93	16.67	14.40	26.33	16.17	7.65	7.17	2.39	37.08	46.35	82.72	74.45
5-May	46.08	29.86	24.25	20.95	50.81	16.75	7.92	0.00	0.00	46.67	58.33	117.07	105.36
6-May	41.08	26.62	33.08	28.58	55.21	24.00	11.35	0.00	0.00	48.00	60.00	126.56	113.90
7-May	33.83	21.92	47.83	41.33	63.25	24.00	11.35	0.00	0.00	47.67	59.58	134.19	120.77
8-May	22.42	14.53	30.00	25.92	40.45	10.08	4.77	4.50	1.50	35.42	44.27	90.98	81.89
9-May	36.75	23.81	48.00	41.47	65.29	22.67	10.72	0.00	0.00	48.00	60.00	136.01	122.41
10-May	29.08	18.85	34.92	30.17	49.01	24.00	11.35	0.00	0.00	48.00	60.00	120.37	108.33
11-May	24.00	15.55	48.00	41.47	57.02	24.00	11.35	0.00	0.00	48.00	60.00	128.38	115.54
12-May	33.42	21.65	48.00	41.47	63.13	8.33	3.94	14.92	4.97	48.00	60.00	132.03	118.83
13-May	21.17	13.72	35.42	30.60	44.32	5.42	2.56	23.75	7.91	48.00	60.00	114.79	103.31
14-May	60.33	39.10	10.75	9.29	48.38	15.58	7.37	24.00	7.99	48.00	60.00	123.75	111.37
15-May	54.00	34.99	24.00	20.74	55.73	24.00	11.35	21.42	7.13	48.00	60.00	134.21	120.79
16-May	46.25	29.97	24.00	20.74	50.71	24.00	11.35	0.00	0.00	48.00	60.00	122.06	109.85
17-May	43.50	28.19	24.00	20.74	48.92	21.92	10.37	1.33	0.44	48.00	60.00	119.73	107.76
18-May	51.33	33.26	24.00	20.74	54.00	24.00	11.35	0.00	0.00	48.00	60.00	125.35	112.82
19-May	60.33	39.10	24.00	20.74	59.83	24.00	11.35	12.25	4.08	48.00	60.00	135.26	121.74
20-May	38.75	25.11	31.67	27.36	52.47	23.58	11.15	24.00	7.99	48.00	60.00	131.62	118.46
21-May	12.75	8.26	48.00	41.47	49.73	23.92	11.31	24.00	7.99	48.00	60.00	129.04	116.13
22-May	24.00	15.55	48.00	41.47	57.02	18.67	8.83	23.25	7.74	48.00	60.00	133.60	120.24
23-May	24.00	15.55	48.00	41.47	57.02	23.83	11.27	3.25	1.08	48.00	60.00	129.38	116.44
24-May	23.83	15.44	47.67	41.18	56.63	23.75	11.23	0.00	0.00	47.67	59.58	127.45	114.70
25-May	63.08	40.88	22.92	19.80	60.68	23.33	11.04	11.83	3.94	45.50	56.88	132.53	119.28
26-May	48.00	31.10	24.00	20.74	51.84	24.00	11.35	14.33	4.77	48.00	60.00	127.97	115.17
27-May	35.50	23.00	29.25	25.27	48.28	18.08	8.55	24.00	7.99	48.00	60.00	124.82	112.34
28-May	24.00	15.55	42.83	37.01	52.56	14.58	6.90	24.00	7.99	48.00	60.00	127.45	114.70
29-May	23.75	15.39	40.83	35.28	50.67	23.75	11.23	23.75	7.91	46.92	58.65	128.46	115.61
30-May	35.08	22.73	26.17	22.61	45.34	23.92	11.31	16.33	5.44	48.00	60.00	122.09	109.88
31-May	43.67	28.30	23.67	20.45	48.74	23.67	11.19	23.58	7.85	47.00	58.75	126.54	113.89
Total	**1136.42**	**736.40**	**1010.08**	**872.71**	**1609.11**	**624.33**	**295.31**	**342.17**	**113.94**	**1456.75**	**1820.94**	**3839.30**	**3455.37**
Average		**23.75**		**28.15**	**51.91**		**9.53**		**3.68**		**58.74**	**123.85**	**111.46**

Average raw water pumped per day : **123.85 MLD**

Average clear water pumped per day : **111.46 MLD**

MONTH : June-04

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Jun	49.92	32.35	23.67	20.45	52.79	23.83	11.27	23.83	7.94	47.42	59.27	131.27	118.15
2-Jun	29.33	19.01	32.58	28.15	47.16	21.42	10.13	16.50	5.49	17.25	21.56	84.35	75.91
3-Jun	32.42	21.01	24.58	21.24	42.25	23.00	10.88	22.42	7.46	45.75	57.19	117.78	106.00
4-Jun	46.33	30.02	23.17	20.02	50.04	23.08	10.92	22.92	7.63	45.58	56.98	125.57	113.01
5-Jun	46.25	29.97	31.17	26.93	56.90	10.33	4.89	22.42	7.46	32.42	40.52	109.77	98.79
6-Jun	41.75	27.05	41.08	35.50	62.55	5.92	2.80	23.08	7.69	36.92	46.15	119.18	107.26
7-Jun	60.33	39.10	48.00	41.47	80.57	23.92	11.31	19.08	6.35	31.50	39.38	137.61	123.85
8-Jun	60.83	39.42	44.42	38.38	77.80	20.08	9.50	23.17	7.71	28.92	36.15	131.16	118.04
9-Jun	65.50	42.44	33.00	28.51	70.96	22.08	10.45	18.58	6.19	32.08	40.10	127.69	114.92
10-Jun	70.08	45.41	33.08	28.58	74.00	23.58	11.15	19.33	6.44	23.33	29.17	120.76	108.68
11-Jun	51.67	33.48	36.50	31.54	65.02	23.75	11.23	23.33	7.77	23.67	29.58	113.60	102.24
12-Jun	60.50	39.20	48.00	41.47	80.68	24.00	11.35	24.00	7.99	24.00	30.00	130.02	117.02
13-Jun	60.42	39.15	45.75	39.53	78.68	23.75	11.23	23.42	7.80	23.75	29.69	127.40	114.66
14-Jun	84.75	54.92	30.58	26.42	81.34	23.83	11.27	23.42	7.80	24.00	30.00	130.41	117.37
15-Jun	71.83	46.55	44.17	38.16	84.71	23.33	11.04	23.00	7.66	24.00	30.00	133.40	120.06
16-Jun	63.33	41.04	30.08	25.99	67.03	14.25	6.74	17.83	5.94	23.33	29.17	108.88	97.99
17-Jun	67.92	44.01	40.17	34.70	78.71	23.67	11.19	23.67	7.88	23.58	29.48	127.27	114.54
18-Jun	63.67	41.26	48.00	41.47	82.73	24.00	11.35	24.00	7.99	24.00	30.00	132.07	118.86
19-Jun	67.50	43.74	42.25	36.50	80.24	24.00	11.35	24.00	7.99	24.00	30.00	129.59	116.63
20-Jun	88.25	57.19	26.58	22.97	80.15	24.00	11.35	24.00	7.99	24.00	30.00	129.50	116.55
21-Jun	72.00	46.66	44.33	38.30	84.96	24.00	11.35	24.00	7.99	24.00	30.00	134.30	120.87
22-Jun	48.25	31.27	46.75	40.39	71.66	23.58	11.15	23.50	7.83	35.50	44.38	135.01	121.51
23-Jun	47.33	30.67	33.58	29.02	59.69	19.83	9.38	9.83	3.27	47.08	58.85	131.20	118.08
24-Jun	56.00	36.29	24.00	20.74	57.02	24.00	11.35	14.08	4.69	48.00	60.00	133.07	119.76
25-Jun	71.25	46.17	2.08	1.80	47.97	23.92	11.31	3.17	1.05	47.08	58.85	119.19	107.27
26-Jun	58.67	38.02	4.58	3.96	41.98	22.67	10.72	0.00	0.00	48.00	60.00	112.70	101.43
27-Jun	48.00	31.10	24.00	20.74	51.84	24.00	11.35	10.75	3.58	48.00	60.00	126.77	114.09
28-Jun	48.08	31.16	18.08	15.62	46.78	21.92	10.37	21.83	7.27	48.00	60.00	124.42	111.98
29-Jun	34.83	22.57	29.50	25.49	48.06	24.00	11.35	24.00	7.99	48.00	60.00	127.40	114.66
30-Jun	6.42	4.16	48.00	41.47	45.63	24.00	11.35	21.67	7.22	48.00	60.00	124.20	111.78
Total	**1673.42**	**1084.37**	**1001.75**	**865.51**	**1949.89**	**657.75**	**311.12**	**594.83**	**198.08**	**1021.17**	**1276.46**	**3735.54**	**3361.99**
Average		**36.15**		**28.85**	**65.00**		**10.37**		**6.60**		**42.55**	**124.52**	**112.07**

Average raw water pumped per day : **124.52 MLD**

Average clear water pumped per day : **112.07 MLD**

Table M31.2.4 Flow Rate of Opa Water Treatment Plant in 2004 (4/5)

MONTH : JULY 2004

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Jul	11.92	7.72	48.00	41.47	49.19	24.00	11.35	2.67	0.89	48.00	60.00	121.43	109.29
2-Jul	21.58	13.99	42.00	36.29	50.27	24.00	11.35	0.00	0.00	48.00	60.00	121.63	109.46
3-Jul	58.67	38.02	36.42	31.46	69.48	23.25	11.00	3.00	1.00	34.42	43.02	124.50	112.05
4-Jul	92.33	59.83	24.00	20.74	80.57	24.00	11.35	0.00	0.00	26.75	33.44	125.36	112.82
5-Jul	35.67	23.11	32.67	28.22	51.34	24.00	11.35	0.00	0.00	48.00	60.00	122.69	110.42
6-Jul	21.92	14.20	36.92	31.90	46.10	24.00	11.35	11.58	3.86	48.00	60.00	121.31	109.18
7-Jul	33.92	21.98	26.42	22.82	44.80	23.67	11.19	22.92	7.63	48.00	60.00	123.63	111.26
8-Jul	42.67	27.65	24.00	20.74	48.38	23.67	11.19	24.00	7.99	48.00	60.00	127.57	114.81
9-Jul	29.00	18.79	27.83	24.05	42.84	24.00	11.35	24.00	7.99	48.00	60.00	122.18	109.97
10-Jul	24.00	15.55	45.83	39.60	55.15	24.00	11.35	24.00	7.99	48.00	60.00	134.50	121.05
11-Jul	24.00	15.55	36.67	31.68	47.23	24.00	11.35	24.00	7.99	48.00	60.00	126.58	113.92
12-Jul	12.33	7.99	39.75	34.34	42.34	24.00	11.35	24.00	7.99	48.00	60.00	121.68	109.51
13-Jul	21.50	13.93	37.75	32.62	46.55	24.00	11.35	6.08	2.03	48.00	60.00	119.93	107.93
14-Jul	23.83	15.44	37.75	32.62	48.06	23.83	11.27	7.00	2.33	47.08	58.85	120.52	108.47
15-Jul	30.58	19.82	31.92	27.58	47.39	24.00	11.35	5.67	1.89	48.00	60.00	120.63	108.57
16-Jul	21.58	13.99	35.17	30.38	44.37	24.00	11.35	21.83	7.27	48.00	60.00	122.99	110.69
17-Jul	15.75	10.21	42.92	37.08	47.29	24.00	11.35	11.83	3.94	41.50	51.88	114.45	103.01
18-Jul	19.17	12.42	29.17	25.20	37.62	24.00	11.35	24.00	7.99	46.00	57.50	114.46	103.02
19-Jul	38.42	24.89	21.17	18.29	43.18	24.00	11.35	24.00	7.99	48.00	60.00	122.53	110.27
20-Jul	43.58	28.24	17.67	15.26	43.51	18.17	8.59	21.75	7.24	48.00	60.00	119.34	107.41
21-Jul	34.83	22.57	21.67	18.72	41.29	24.00	11.35	17.50	5.83	48.00	60.00	118.47	106.62
22-Jul	48.00	31.10	10.00	8.64	39.74	24.00	11.35	5.75	1.91	48.00	60.00	113.01	101.71
23-Jul	52.33	33.91	9.92	8.57	42.48	24.00	11.35	20.17	6.72	39.67	49.58	110.13	99.12
24-Jul	61.17	39.64	33.67	29.09	68.72	23.83	11.27	20.50	6.83	24.00	30.00	116.82	105.14
25-Jul	48.00	31.10	48.00	41.47	72.58	23.92	11.31	16.83	5.61	24.00	30.00	119.49	107.54
26-Jul	57.75	37.42	34.75	30.02	67.45	23.92	11.31	24.00	7.99	24.75	30.94	117.69	105.92
27-Jul	69.00	44.71	20.75	17.93	62.64	22.42	10.60	23.58	7.85	24.00	30.00	111.10	99.99
28-Jul	48.00	31.10	28.33	24.48	55.58	19.83	9.38	21.17	7.05	31.08	38.85	110.87	99.78
29-Jul	56.42	36.56	32.08	27.72	64.28	22.92	10.84	11.42	3.80	24.25	30.31	109.23	98.31
30-Jul	71.58	46.39	23.00	19.87	66.26	23.33	11.04	23.25	7.74	23.50	29.38	114.41	102.97
31-Jul	63.92	41.42	41.58	35.93	77.35	19.33	9.14	22.08	7.35	22.50	28.13	121.97	109.77
Total	**1233.42**	**799.25**	**977.75**	**844.78**	**1644.03**	**724.08**	**342.49**	**488.58**	**162.70**	**1249.50**	**1561.88**	**3711.09**	**3339.99**
Average		**25.78**		**27.25**	**53.03**		**11.05**		**5.25**		**50.38**	**119.71**	**107.74**

Average raw water pumped per day : **119.71 MLD**

Average clear water pumped per day : **107.74 MLD**

MONTH : AUG 2004

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Aug	72.92	47.25	36.67	31.68	78.93	23.33	11.04	23.17	7.71	23.33	29.17	126.85	114.16
2-Aug	55.58	36.02	48.00	41.47	77.49	24.00	11.35	23.92	7.96	24.00	30.00	126.81	114.13
3-Aug	57.75	37.42	35.25	30.46	67.88	23.58	11.15	23.58	7.85	24.00	30.00	116.89	105.20
4-Aug	48.25	31.27	41.67	36.00	67.27	22.50	10.64	24.00	7.99	24.00	30.00	115.90	104.31
5-Aug	70.83	45.90	42.08	36.36	82.26	22.83	10.80	23.75	7.91	23.67	29.58	130.55	117.50
6-Aug	58.75	38.07	30.83	26.64	64.71	22.75	10.76	23.50	7.83	23.67	29.58	112.88	101.59
7-Aug	80.92	52.43	34.17	29.52	81.95	24.00	11.35	24.00	7.99	24.00	30.00	131.30	118.17
8-Aug	68.33	44.28	36.92	31.90	76.18	20.67	9.78	24.00	7.99	24.00	30.00	123.94	111.55
9-Aug	80.67	52.27	25.25	21.82	74.09	23.92	11.31	24.00	7.99	24.00	30.00	123.39	111.05
10-Aug	72.17	46.76	24.00	20.74	67.50	19.00	8.99	24.00	7.99	21.92	27.40	111.87	100.69
11-Aug	54.25	35.15	24.00	20.74	55.89	24.00	11.35	24.00	7.99	33.33	41.67	116.90	105.21
12-Aug	24.00	15.55	41.92	36.22	51.77	22.58	10.68	19.67	6.55	47.25	59.06	128.06	115.26
13-Aug	39.17	25.38	24.00	20.74	46.12	19.50	9.22	21.50	7.16	48.00	60.00	122.50	110.25
14-Aug	26.08	16.90	33.00	28.51	45.41	23.92	11.31	20.17	6.72	48.00	60.00	123.44	111.10
15-Aug	25.75	16.69	33.00	28.51	45.20	24.00	11.35	18.42	6.13	48.00	60.00	122.68	110.41
16-Aug	47.67	30.89	22.75	19.66	50.54	21.92	10.37	23.50	7.83	43.92	54.90	123.63	111.27
17-Aug	44.17	28.62	23.58	20.38	49.00	19.92	9.42	23.50	7.83	47.42	59.27	125.51	112.96
18-Aug	34.25	22.19	24.00	20.74	42.93	24.00	11.35	18.50	6.16	47.75	59.69	120.13	108.12
19-Aug	53.25	34.51	35.83	30.96	65.47	22.08	10.45	23.67	7.88	21.67	27.08	110.88	99.79
20-Aug	79.67	51.62	34.92	30.17	81.79	24.00	11.35	17.08	5.69	12.42	15.52	114.35	102.92
21-Aug	77.17	50.00	17.58	15.19	65.20	23.92	11.31	18.50	6.16	33.00	41.25	123.92	111.53
22-Aug	39.00	25.27	31.58	27.29	52.56	23.00	10.88	11.58	3.86	48.00	60.00	127.30	114.57
23-Aug	41.42	26.84	28.50	24.62	51.46	23.92	11.31	22.08	7.35	42.25	52.81	122.94	110.65
24-Aug	24.08	15.61	28.50	24.62	40.23	24.00	11.35	16.75	5.58	47.92	59.90	117.06	105.35
25-Aug	40.75	26.41	24.00	20.74	47.14	23.92	11.31	20.08	6.69	47.92	59.90	125.04	112.53
26-Aug	37.08	24.03	18.08	15.62	39.65	23.00	10.88	18.67	6.22	48.00	60.00	116.75	105.07
27-Aug	50.00	32.40	22.67	19.58	51.98	24.00	11.35	24.00	7.99	38.92	48.65	119.97	107.98
28-Aug	51.75	33.53	47.08	40.68	74.21	22.83	10.80	22.92	7.63	24.00	30.00	122.65	110.38
29-Aug	84.83	54.97	19.17	16.56	71.53	19.50	9.22	19.33	6.44	24.00	30.00	117.19	105.47
30-Aug	83.67	54.22	20.75	17.93	72.14	22.67	10.72	23.25	7.74	23.58	29.48	120.09	108.08
31-Aug	33.33	21.60	41.17	35.57	57.17	21.50	10.17	23.75	7.91	37.58	46.98	122.23	110.00
Total	**1657.50**	**1074.06**	**950.92**	**821.59**	**1895.65**	**704.75**	**333.35**	**668.83**	**222.72**	**1049.50**	**1311.88**	**3763.60**	**3387.24**
Average		**34.65**		**26.50**	**61.15**		**10.75**		**7.18**		**42.32**	**121.41**	**109.27**

Average raw water pumped per day : **121.41 MLD**

Average clear water pumped per day : **109.27 MLD**

Table M31.2.4 Flow Rate of Opa Water Treatment Plant in 2004 (5/5)

MONTH : **Sep-04**

DATE	72 MLD					12 MLD		8 MLD		VT		TOTAL MLD	10% LESS
	648 m^3/hr		864 m^3/hr		Total (MLD)	473 m^3/hr		333 m^3/hr		1250 m^3/hr			
	TOTAL HRS	MLD	TOTAL HRS	MLD		TOTAL HRS	MLD	TOTAL HRS	MLD	TOTAL HRS	MLD		
1-Sep	17.58	11.39	44.33	38.30	49.70	24.00	11.35	22.33	7.44	48.00	60.00	128.49	115.64
2-Sep	32.67	21.17	30.75	26.57	47.74	22.25	10.52	9.17	3.05	48.00	60.00	121.31	109.18
3-Sep	24.00	15.55	45.25	39.10	54.65	23.83	11.27	10.75	3.58	48.00	60.00	129.50	116.55
4-Sep	45.33	29.38	23.67	20.45	49.82	23.67	11.19	19.50	6.49	47.17	58.96	126.47	113.82
5-Sep	48.00	31.10	24.00	20.74	51.84	22.42	10.60	17.25	5.74	48.00	60.00	128.19	115.37
6-Sep	42.75	27.70	24.08	20.81	48.51	23.67	11.19	23.42	7.80	46.50	58.13	125.63	113.06
7-Sep	20.92	13.55	31.08	26.86	40.41	10.58	5.01	23.33	7.77	46.50	58.13	111.31	100.18
8-Sep	44.17	28.62	24.00	20.74	49.36	17.83	8.44	21.83	7.27	48.00	60.00	125.06	112.56
9-Sep	43.75	28.35	24.00	20.74	49.09	24.00	11.35	6.33	2.11	48.00	60.00	122.55	110.29
10-Sep	47.08	30.51	24.00	20.74	51.25	21.58	10.21	12.92	4.30	48.00	60.00	125.76	113.18
11-Sep	50.58	32.78	24.00	20.74	53.51	20.58	9.74	23.08	7.69	43.50	54.38	125.31	112.78
12-Sep	34.75	22.52	19.08	16.49	39.01	24.00	11.35	15.00	5.00	48.00	60.00	115.35	103.82
13-Sep	43.25	28.03	19.83	17.14	45.16	22.67	10.72	24.00	7.99	48.00	60.00	123.88	111.49
14-Sep	38.33	24.84	24.00	20.74	45.58	18.75	8.87	21.25	7.08	48.00	60.00	121.52	109.37
15-Sep	45.00	29.16	20.08	17.35	46.51	20.58	9.74	20.08	6.69	47.25	59.06	122.00	109.80
16-Sep	48.00	31.10	24.00	20.74	51.84	18.92	8.95	10.25	3.41	48.00	60.00	124.20	111.78
17-Sep	48.00	31.10	24.00	20.74	51.84	24.00	11.35	7.75	2.58	48.00	60.00	125.77	113.20
18-Sep	47.68	30.90	23.93	20.68	51.58	22.18	10.49	23.35	7.78	47.53	59.42	129.26	116.34
19-Sep	47.50	30.78	23.92	20.66	51.44	23.33	11.04	11.08	3.69	47.33	59.17	125.34	112.80
20-Sep	40.67	26.35	24.00	20.74	47.09	23.50	11.12	23.50	7.83	48.00	60.00	126.03	113.43
21-Sep	39.23	25.42	24.00	20.74	46.16	23.83	11.27	24.00	7.99	48.00	60.00	125.42	112.88
22-Sep	42.50	27.54	24.00	20.74	48.28	24.00	11.35	24.00	7.99	48.00	60.00	127.62	114.86
23-Sep	33.42	21.65	24.92	21.53	43.18	24.00	11.35	24.00	7.99	48.00	60.00	122.53	110.27
24-Sep	28.42	18.41	34.08	29.45	47.86	24.00	11.35	21.50	7.16	48.00	60.00	126.37	113.74
25-Sep	40.33	26.14	23.08	19.94	46.08	20.17	9.54	18.33	6.11	46.00	57.50	119.22	107.30
26-Sep	42.08	27.27	24.00	20.74	48.01	21.83	10.33	24.00	7.99	48.00	60.00	126.33	113.69
27-Sep	34.17	22.14	28.75	24.84	46.98	18.50	8.75	23.42	7.80	46.58	58.23	121.76	109.58
28-Sep	42.42	27.49	24.00	20.74	48.22	19.00	8.99	21.58	7.19	48.00	60.00	124.40	111.96
29-Sep	48.50	31.43	16.08	13.90	45.32	24.00	11.35	16.58	5.52	48.00	60.00	122.20	109.98
30-Sep	57.25	37.10	12.83	11.09	48.19	19.17	9.07	21.92	7.30	47.33	59.17	123.72	111.35
Total	**1218.33**	**789.48**	**757.77**	**654.71**	**1444.19**	**650.85**	**307.85**	**565.52**	**188.32**	**1425.70**	**1782.13**	**3722.48**	**3350.24**
Average		**26.32**		**21.82**	**48.14**		**10.26**		**6.28**		**59.40**	**124.08**	**111.67**

Average raw water pumped per day : **124.08 MLD**

Average clear water pumped per day : **111.67 MLD**

Table M31.2.5 Monthly Water Quality of Opa WTP (Curti 72MLD) Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

	Color			Odor			Taste			Turbidity (NTU)			pH			Specific Conductivity (/u mhos/cm)			Total Solids (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0			U			Unobjectable			6.7			6.9			76.5			51.0		
Feb-03	0			n			Unobjectable			3.7			7.0			84.1			56.0		
Mar-03	0			o			Unobjectable			6.5			6.9			110.1			72.0		
Apr-03	0			b			Unobjectable			5.1			6.9			120.1			78.0		
May-03	0			j			Unobjectable			7.3			6.9			139.8			91.0		
Jun-03	5			e			Unobjectable			23.9			6.7			47.6			36.5		
Jul-03	10			c			Unobjectable			42.7			6.4			48.1			44.0		
Aug-03	5			t			Unobjectable			31.7			6.3			45.6			40.0		
Sep-03	5			a			Unobjectable			25.5			7.1			49.9			40.5		
Oct-03	0			b			Unobjectable			9.0			7.3			56.5			39.0		
Nov-03	0			l			Unobjectable			7.2			7.0			61.8			42.0		
Dec-03	0			e			Unobjectable			5.0			7.0			76.2			50.5		
Jan-04	0		0				Unobjectable			3.5		0.9	7.1		7.3	76.8		96.0	50.5		
Feb-04	0		0				Unobjectable			3.6		0.6	7.0		7.2	83.8		105.6	55.0		
Mar-04	0	0	0	Unobjectable			Unobjectable			4.0	0.4	0.4	7.4	7.3	7.4	96.8	98.9	99.2	63.5	63.0	63.0
Apr-04	0	0	0	Unobjectable			Unobjectable			8.0	2.0	1.2	7.1	7.2	7.2	105.7	105.1	112.9	70.0	67.5	72.0
May-04	0	0	0	Unobjectable			Unobjectable			6.3	1.6	1.5	7.3	7.1	7.1	102.4	101.4	109.5	67.0	65.0	70.0
Jun-04	0	0	0	Unobjectable			Unobjectable			14.5	0.8	0.6	6.9	6.8	6.9	81.8	84.8	86.6	56.5	54.0	55.0
Jul-04	40	0	0	Unobjectable			Unobjectable			274.4	1.2	1.1	6.5	6.7	6.8	41.4	51.7	56.8	107.0	33.0	36.0
Aug-04	70	0	0	Unobjectable			Unobjectable			730.0	2.1	2.0	6.6	6.9	7.0	31.5	48.4	50.3	191.5	31.0	32.0
Sep-04	0	0	0	Unobjectable			Unobjectable			8.0	1.0	1.0	7.1	7.1	7.1	49.8	60.2	62.1	34.5	38.5	39.5
Oct-04	20	0	0	Unobjectable			Unobjectable			96.5	0.8	1.0	7.0	7.1	7.3	45.3	58.2	63.9	55.5	37.0	37.0
Nov-04	0	0	0	Unobjectable			Unobjectable			12.8	2.2	2.3	7.2	7.1	7.2	66.5	65.7	68.6	46.0	42.0	44.0
Dec-04	0	0	0	Unobjectable			Unobjectable			6.9	1.6	2.2	7.4	7.5	7.5	69.3	69.8	70.6	46.0	45.0	46.0
Jan-05	0	0	0	Unobjectable			Unobjectable			5.6	1.9	2.0	7.1	7.3	7.3	73.5	74.9	76.3	49.0	48.0	48.5
Feb-05	0	0	0	Unobjectable			Unobjectable			5.3	1.6	1.2	6.6	6.7	7.0	71.3	72.8	73.0	47.5	46.0	46.0
Mar-05	0	0	0	Unobjectable			Unobjectable			5.3	1.7	1.6	7.0	7.0	7.0	89.8	90.7	90.4	59.0	58.0	58.0
Apr-05	0	0	0	Unobjectable			Unobjectable			8.0	2.5	2.0	7.0	7.0	7.0	99.6	100.5	106.1	66.5	64.0	67.0
May-05	0	0	0	Unobjectable			Unobjectable			5.4	2.4	1.9	7.3	7.3	7.2	100.0	100.6	113.2	66.0	64.0	72.0
Max	70.0	0.0	0.0							730.0	2.5	2.3	7.4	7.5	7.5	139.8	105.1	113.2	191.5	67.5	72.0
Min	0.0	0.0	0.0	Unobjectable			Unobjectable			3.5	0.4	0.4	6.3	6.7	6.8	31.5	48.4	50.3	34.5	31.0	32.0
Ave	5.3	0.0	0.0							47.3	1.6	1.4	7.0	7.1	7.1	75.9	78.9	84.8	61.1	50.4	52.4

	Total Dissolved Solids(TDS) (mg/L)			Suspended Solids (mg/L)			Total Hardness as $CaCO_3$ (TA (mg/L)			Ca^{2+} (mg/L)			Mg^{2+} (mg/L)			Cl^- (mg/L)			Total Alkalinity as $CaCO_3$ (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	49.0			2.0			30.0			8.8			2.00			6.00			27.00		
Feb-03	54.0			2.0			33.0			9.6			2.25			6.00			33.00		
Mar-03	70.0			2.0			51.0			13.6			4.25			6.00			50.00		
Apr-03	76.0			2.0			54.0			14.4			4.50			6.00			34.00		
May-03	89.0			2.0			64.0			15.2			6.50			8.00			65.00		
Jun-03	30.5			6.0			20.0			3.6			2.75			6.00			18.00		
Jul-03	31.0			13.0			20.0			4.0			2.30			6.00			15.00		
Aug-03	30.0			10.0			14.0			3.2			1.50			4.00			17.00		
Sep-03	32.0			8.5			17.0			3.2			2.25			6.00			20.00		
Oct-03	36.0			3.0			24.0			5.6			2.50			6.00			23.00		
Nov-03	40.0			2.0			27.0			6.0			3.00			6.00			29.00		
Dec-03	49.0			1.5			30.0			7.2			3.00			6.00			32.00		
Jan-04	49.0			1.5			30.0		33.0	7.2			3.00			6.00		6.50	30.00		32.00
Feb-04	53.5			1.5			34.0		37.0	8.8			3.00			6.00		6.30	38.00		
Mar-04	62.0	63.0	63.0	1.5	0.0	0.0	38.0	40.0	40.0	10.0	10.8	10.8	3.25	3.25	3.25	6.00	6.00	6.00	42.00	43.00	44.00
Apr-04	67.5	67.0	72.0	2.5	0.5	0.0	43.0	43.0	43.0	10.8	10.8	10.8	4.00	4.00	4.00	6.00	6.00	8.00	51.00	51.00	51.00
May-04	65.0	65.0	70.0	2.0	0.0	0.0	40.0	40.0	40.0	10.0	10.0	10.0	3.75	3.75	3.75	7.00	7.00	9.00	44.00	44.00	44.00
Jun-04	52.5	54.0	55.0	4.0	0.0	0.0	37.0	40.0	40.0	9.6	10.0	10.0	3.25	3.75	3.75	6.00	7.00	7.00	40.00	42.00	42.00
Jul-04	27.5	33.0	36.0	79.5	0.0	0.0	14.0	18.0	18.0	3.6	4.8	4.8	1.25	1.50	1.50	6.00	6.00	7.00	12.00	18.00	18.00
Aug-04	20.5	31.0	32.0	171.0	0.0	0.0	11.0	20.0	20.0	2.8	6.4	6.4	1.00	1.00	1.00	5.00	6.00	6.00	10.00	16.00	16.00
Sep-04	32.0	38.5	39.8	2.5	0.0	0.0	18.0	21.0	22.0	4.4	5.2	5.6	1.75	2.00	2.00	5.00	5.00	7.00	19.00	21.00	23.00
Oct-04	30.0	37.0	37.0	25.5	0.0	0.0	16.0	24.0	24.0	3.6	5.6	5.6	1.75	2.50	2.50	5.00	5.00	5.00	19.00	26.00	26.00
Nov-04	43.0	42.0	44.0	3.0	0.0	0.0	26.0	24.0	24.0	6.0	6.0	6.0	2.75	2.25	2.25	6.00	7.00	8.00	27.00	25.00	25.00
Dec-04	44.0	45.0	46.0	2.0	0.0	0.0	29.0	29.0	29.0	7.6	7.6	7.6	2.50	2.50	2.50	6.00	6.00	8.00	33.00	30.00	30.00
Jan-05	47.0	48.0	48.5	2.0	0.0	0.0	31.0	32.0	32.0	8.4	8.8	8.8	2.50	2.50	2.50	7.00	7.00	8.00	31.00	33.00	33.00
Feb-05	45.0	46.0	46.0	2.5	0.0	0.0	29.0	29.0	29.0	8.8	8.8	8.8	1.75	1.75	1.75	7.00	7.00	7.00	30.00	30.00	32.00
Mar-05	57.5	58.0	58.0	1.5	0.0	0.0	38.0	38.0	38.0	10.0	10.0	10.0	3.25	3.25	3.25	6.00	6.00	6.00	38.00	38.00	38.00
Apr-05	64.0	64.0	67.0	2.5	0.0	0.0	42.0	42.0	43.0	9.6	9.6	10.0	4.50	4.50	4.50	7.00	7.00	7.00	42.00	43.00	43.00
May-05	64.0	64.0	72.0	2.0	0.0	0.0	40.0	39.0	41.0	10.4	10.4	11.2	3.50	3.25	3.25	7.00	7.00	11.00	38.00	38.00	37.00
Max	89.0	67.0	72.0	171.0	0.5	0.0	64.0	43.0	43.0	15.2	10.8	11.2	6.50	4.50	4.50	8.00	7.00	11.00	65.00	51.00	51.00
Min	20.5	31.0	32.0	1.5	0.0	0.0	11.0	18.0	18.0	2.8	4.8	4.8	1.00	1.00	1.00	4.00	5.00	5.00	10.00	16.00	16.00
Ave	48.6	50.4	52.4	12.4	0.0	0.0	31.0	31.9	32.5	7.8	8.3	8.4	2.88	2.78	2.78	6.07	6.33	7.22	31.28	33.20	33.38

Table M31.2.5 Monthly Water Quality of Opa WTP (Curti 72MLD) Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

	SO_4^- (mg/L)			Fe^{2+} (mg/L)			Mn^{2+} (mg/L)			NO_3^{2-} (mg/L)			$KMnO_4$ oxidizability as O_2 (mg/L)			BOD at 27°C and 3days (mg/L)			DO (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0.00			0.50			0.00			0.8			0.2			0.5					
Feb-03	0.00			0.10			0.00			0.4			0.2			0.5					
Mar-03	0.00			1.10			0.00			0.6			0.3			0.8					
Apr-03	0.00			0.50			0.00			0.6			0.3			0.8					
May-03	0.00			0.30			0.00			0.8			0.4			1.0					
Jun-03	0.00			0.64			0.00			0.7			0.6			1.5					
Jul-03	0.00			2.30			0.00			1.7			1.0			2.5					
Aug-03	0.00			2.60			0.00			1.3			0.8			2.0					
Sep-03	0.00			1.60			0.00			0.9			0.8			2.0					
Oct-03	0.00			0.90			0.00			0.8			0.4			1.0					
Nov-03	0.00			0.50			0.00			1.4			0.4			1.0			7.0		
Dec-03	0.00			0.50			0.00			1.8			0.4			1.2			7.2		
Jan-04	0.00			0.30			0.00			2.1			0.4			1.1			7.2		7.2
Feb-04	0.00			0.30			0.00			2.2			0.4			0.8			7.1		7.0
Mar-04	0.00	0.00	0.00	0.35	0.05	0.05	0.00	0.00	0.00	1.8	0.0	0.0	0.3	0.0	0.0	0.8	0.0	0.0	7.3	7.4	7.5
Apr-04	0.00	0.00	0.00	0.70	0.10	0.10	0.00	0.00	0.00	1.8	0.4	0.0	0.4	0.2	0.0	1.5	0.5	0.0	6.8	7.1	7.4
May-04	0.00	0.00	0.00	0.60	0.10	0.10	0.00	0.00	0.00	1.4	0.0	0.0	0.6	0.0	0.0	1.2	0.0	0.0	6.9	7.0	7.2
Jun-04	0.00	0.00	0.00	1.20	0.05	0.05	0.00	0.00	0.00	1.5	0.0	0.0	1.0	0.0	0.0	1.2	0.0	0.0	6.8	7.2	7.2
Jul-04	0.00	0.00	0.00	5.40	0.10	0.10	0.24	0.00	0.00	5.0	0.0	0.0	3.0	0.0	0.0	4.8	0.0	0.0	6.7	7.1	7.1
Aug-04	0.00	0.00	0.00	14.50	0.10	0.10	1.20	0.00	0.00	6.6	0.0	0.0	4.8	0.0	0.0	6.0	0.0	0.0	7.1	7.6	7.8
Sep-04	0.00	0.00	0.00	0.30	0.10	0.10	0.00	0.00	0.00	0.4	0.0	0.0	0.3	0.0	0.0	0.5	0.0	0.0	7.3	7.4	7.5
Oct-04	0.00	0.00	0.00	2.60	0.05	0.06	0.12	0.00	0.00	1.3	0.0	0.0	1.0	0.0	0.0	2.3	0.0	0.0	7.3	7.4	7.5
Nov-04	0.00	0.00	0.00	0.55	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.8	0.0	0.0	1.0	0.0	0.0	7.2	7.4	7.4
Dec-04	0.00	0.00	0.00	0.40	0.10	0.10	0.00	0.00	0.00	0.4	0.0	0.0	0.4	0.0	0.0	1.2	0.0	0.0	7.3	7.4	7.5
Jan-05	0.00	0.00	0.00	0.40	0.12	0.12	0.00	0.00	0.00	0.6	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.3	7.5	7.5
Feb-05	0.00	0.00	0.00	0.20	0.10	0.10	0.00	0.00	0.00	1.2	0.0	0.0	0.4	0.0	0.0	0.9	0.0	0.0	7.3	7.4	7.4
Mar-05	0.00	0.00	0.00	0.40	0.10	0.10	0.00	0.00	0.00	1.0	0.0	0.0	0.4	0.0	0.0	0.9	0.0	0.0	7.4	7.4	7.4
Apr-05	0.00	0.00	0.00	0.40	0.10	0.10	0.00	0.00	0.00	1.3	0.0	0.0	0.6	0.0	0.0	1.0	0.0	0.0	7.3	7.4	7.5
May-05	0.00	0.00	0.00	0.40	0.10	0.10	0.00	0.00	0.00	1.0	0.0	0.0	0.4	0.0	0.0	0.9	0.0	0.0	6.9	7.2	7.3
Max	0.00	0.00	0.00	14.50	0.12	0.12	1.20	0.00	0.00	6.6	0.4	0.0	4.8	0.2	0.0	6.0	0.5	0.0	7.4	7.6	7.8
Min	0.00	0.00	0.00	0.10	0.05	0.05	0.00	0.00	0.00	0.4	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	6.7	7.0	7.0
Ave	0.00	0.00	0.00	1.40	0.09	0.09	0.05	0.00	0.00	1.4	0.0	0.0	0.7	0.0	0.0	1.4	0.0	0.0	7.1	7.3	7.4

	F^- (mg/L)			Al^{3+} (mg/L)			Plate Count on nutrient agar no/100mL			MPN of Coliform no/100mL			MPN of E.Coli. no/100mL		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0.0						120	70	4	460	240	0	240	93	0
Feb-03	0.0						122	43	0	2,400	460	0	150	25	0
Mar-03	0.0						380	190	2	1,100	240	0	150	93	0
Apr-03	0.0						192	106	2	2,400	95	0	95	11	0
May-03	0.0						403	123	2	4,600	43	0	460	15	0
Jun-03	0.0						186	98	3	2,400	1,100	0	210	93	0
Jul-03	0.0						285	48	3	2,400	460	0	460	43	0
Aug-03	0.0						324	72	2	2,400	93	0	210	21	0
Sep-03	0.0						490	89	2	4,600	460	0	1,100	93	0
Oct-03	0.0						145	51	4	2,400	460	0	1,100	240	0
Nov-03	0.0						226	73	3	1,100	240	0	460	43	0
Dec-03	0.0						211	64	1	2,400	240	0	460	240	0
Jan-04	0.0						144	51	0	2,400	150	0	240	75	0
Feb-04	0.0						122	41	4	460	43	0	93	15	0
Mar-04	0.0	0.0	0.0	0.0	0.0	0.0	182	130	1	1,100	93	0	240	21	0
Apr-04	0.0	0.0	0.0	0.0	0.0	0.0	117	69	1	1,100	240	0	240	28	0
May-04	0.0	0.0	0.0	0.0	0.0	0.0	107	67	2	1,100	460	0	460	93	0
Jun-04	0.0	0.0	0.0	0.0	0.0	0.0	88	24	3	2,400	460	0	1,100	43	0
Jul-04	0.0	0.0	0.0	0.0	0.0	0.0	328	56	1	4,600	240	0	2,400	93	0
Aug-04	0.0	0.0	0.0	0.0	0.0	0.0	223	38	0	4,600	240	0	1,100	43	0
Sep-04	0.0	0.0	0.0	0.0	0.0	0.0	233	64	2	2,400	1,100	0	240	240	0
Oct-04	0.0	0.0	0.0	0.0	0.0	0.0	370	44	2	4,600	240	0	1,100	43	0
Nov-04	0.0	0.0	0.0	0.0	0.0	0.0	92	44	4	1,100	240	0	93	43	0
Dec-04	0.0	0.0	0.0	0.0	0.0	0.0	308	112	3	4,600	43	0	2,400	9	0
Jan-05	0.0	0.0	0.0	0.0	0.0	0.0	129	90	1	1,100	460	0	210	93	0
Feb-05	0.0	0.0	0.0	0.0	0.0	0.0	284	149	4	2,400	75	0	1,100	43	0
Mar-05	0.0	0.0	0.0	0.0	0.0	0.0	140	22	3	1,100	240	0	460	28	0
Apr-05	0.0	0.0	0.0	0.0	0.0	0.0	143	22	4	1,100	240	0	240	93	0
May-05	0.0	0.0	0.0	0.0	0.0	0.0	170	25	0	2,400	43	0	210	43	0
Max	0.0	0.0	0.0	0.0	0.0	0.0	490	190	4	4,600	1,100	0	2,400	240	0
Min	0.0	0.0	0.0	0.0	0.0	0.0	88	22	0	460	43	0	93	9	0
Ave	0.0	0.0	0.0	0.0	0.0	0.0	216	72	2	2,318	301	0	587	71	0

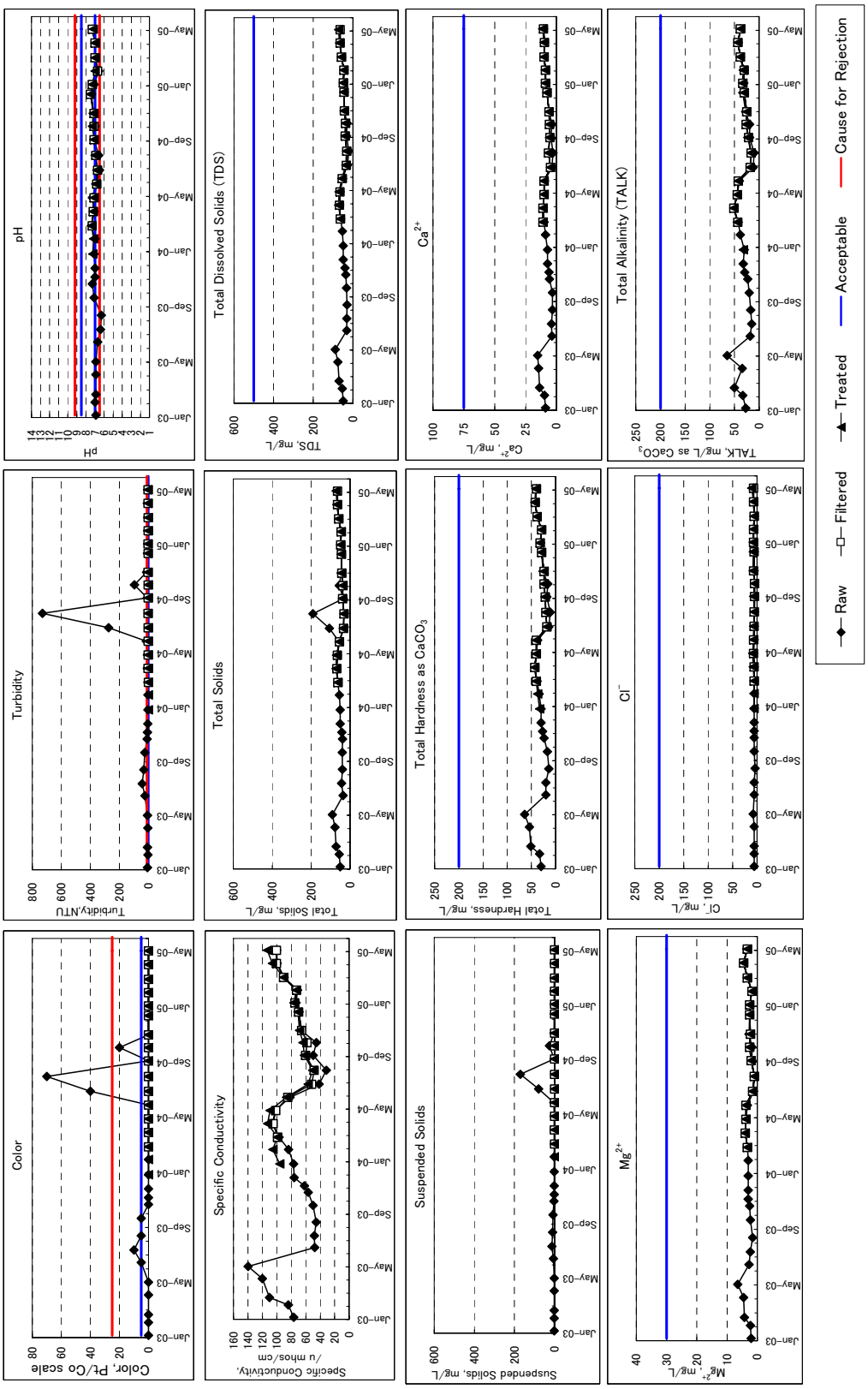

Figure M31.2.3 Monthly Water Quality of Opa WTP (Curti 72MLD) Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

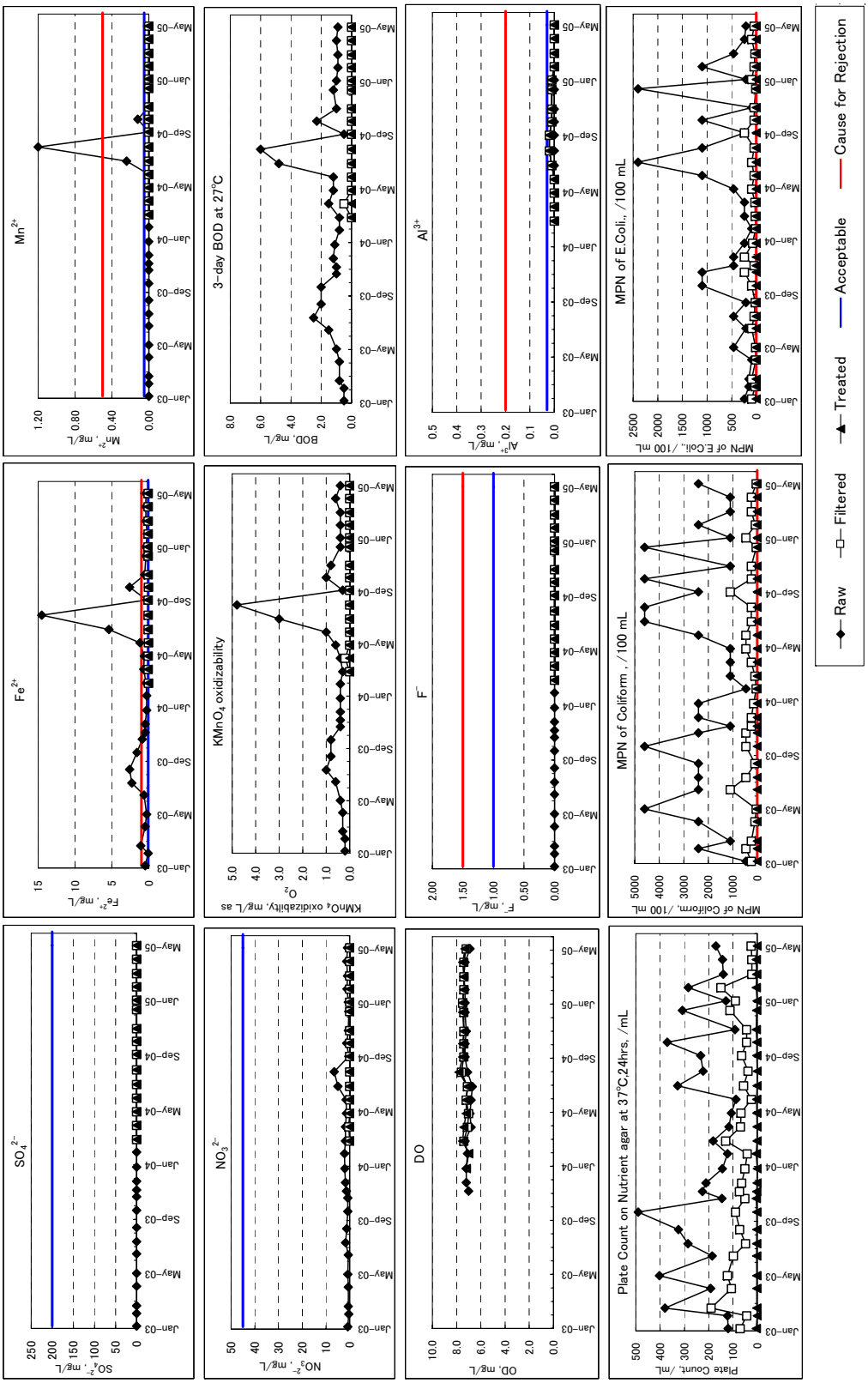

Figure M31.2.3 Monthly Water Quality of Opa WTP (Curti 72MLD) Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

Table M31.2.6 Records on Power Interruption at Opa WTP in 2004

Year	2004	Ave.	4.4	Max.	350.0	Min.	1.0				Unit:	min.
Date	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
1						1.0		20.0			1.0	20.0
2												
3		2.0		10.0		20.0	2.0					
4						25.0			5.0		7.0	20.0
5		15.0	2.0		5.0	27.0		10.0		5.0		85.0
6								2.0	5.0			
7									10.0	5.0		
8	3.0				350.0						5.0	
9						79.0						
10						9.0				2.0	75.0	
11	1.0			5.0		5.0						
12				2.0								
13		2.0				1.0						
14							2.0			44.0		
15				5.0								
16						7.0		1.0		18.0	6.0	
17				125.0		2.0		1.0		10.0		
18			60.0	147.0					2.0			4.0
19			18.0	1.0				5.0	2.0			
20				6.0							2.0	
21	15.0	5.0		20.0								
22						10.0						
23		15.0				10.0						
24					25.0					2.0		
25				2.0	15.0	5.0			40.0			3.0
26		9.0										
27	2.0								7.0			
28	13.0	2.0										
29	3.0	-		22.0							27.0	
30		-					10.0	10.0	3.0		5.0	
31		-		-		-	2.0	1.0	-		-	
Total (min./month)	37.0	50.0	80.0	345.0	395.0	201.0	16.0	50.0	74.0	86.0	128.0	132.0
Ave. (min./day)	1.2	1.8	2.6	11.5	12.7	6.7	0.5	1.6	2.5	2.8	4.3	4.4
Max. (min./day)	15.0	15.0	60.0	147.0	350.0	79.0	10.0	20.0	40.0	44.0	75.0	85.0
Min. (min./day)	1.0	2.0	2.0	1.0	5.0	1.0	2.0	1.0	2.0	2.0	1.0	3.0

Note: Average interruption period means the interruption minutes per day per month .

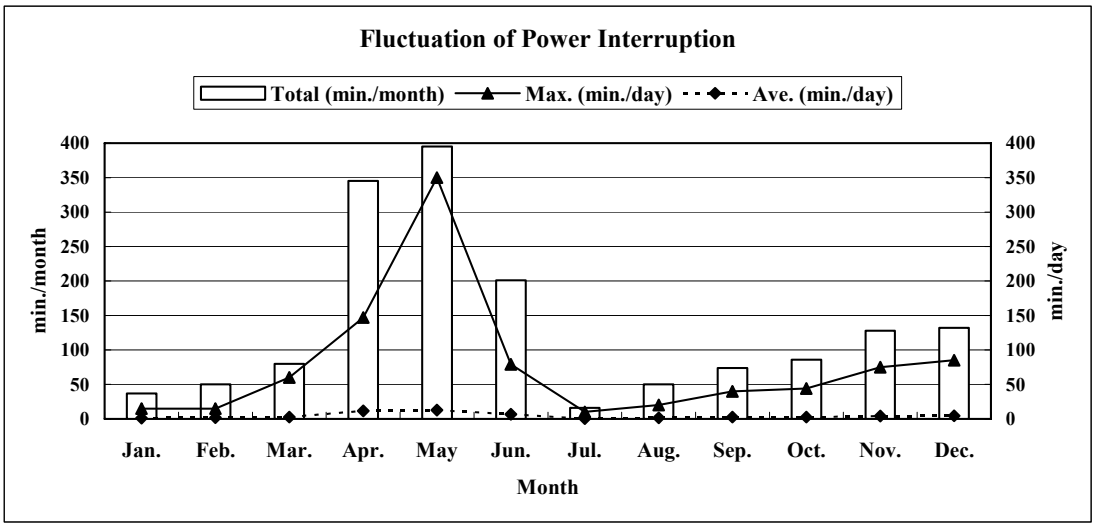

Table M31.2.7 List of Reservoirs for the Opa Water Supply Scheme (1/3)

Series No.	System	Tapping Main		Name of GLR / OHR / Sump (Name of Location)	Type	GLR/OHR/Sump				Supply Area		Remarks
		Dia. (mm)	Material			Capacity (m3)	Elevation (m)			Taluka	Village Name	
							RL	HWL	LWL			
O- 1	Opa WTP			Opa 8MLD	GLR	175						
O- 2				Opa 12MLD	GLR	1,350						
				Sub-Total		**1,525**						
C- 1	Curti MBR			Curti 72MLD	GLR	3,030	154.00	159.00				
C- 2					GLR	3,030	154.00	159.00				
C- 3					GLR	3,030	154.00	159.00				
C- 4				Opa 8MLD & 12MLD	GLR	800	154.00	158.00				
C- 5					GLR	800	154.00	158.00				
C- 6					GLR	800	154.00	158.00				
C- 7					GLR	800	154.00	158.00				
C- 8				Curti 40MLD	GLR	5,000	164.00	168.00				
C- 9					GLR	5,000	164.00	168.00				
				Sub-Total		**22,290**						
W- 1	White Line	200	CIP	Marwaswada	GLR	800	60.00	63.80		Ponda	Usgao(13)	
										Bicholim	Pale(26)	
W- 2		100	CIP	Khandepar	GLR	300	40.00	43.00		Ponda	Vagurbem(11), Candepar(14)	
W- 3		200	CIP	Prabhunagar	GLR	800	58.00	61.80		-ditto-	Betora(22), Curti(CT)(32)	
W- 4		80	CIP	St. Mary Convent, Ponda	GLR	300	42.00	45.00		-ditto-	Ponda(MCI)(31), Curti(CT)(32)	
		200	CIP									
W- 5		150	CIP	Bethoda	GLR	300	60.00			-ditto-	Betora(22), Curti(CT)(32), Ponda(MCI)(31)	
W- 6		200	CIP	Shanti Nagar, Ponda	GLR	800	58.00			-ditto-	Ponda(MCI)(31)	
W- 7		150	CIP	Upper Tank, Forest Dept.	GLR	300	45.00			-ditto-	Queula(30), Durbhat(19), Telaulim(20), Vadi(21), Ponda(MCI)(31)	
W- 8		150	CIP	Middle Tank, Forest Dept.	GLR	800	42.00			-ditto-	Queula(30), Bandora(CT)(29)	
W- 9		80	CIP	Lower Tank, Forest Dept.	Sump	300	40.00			-ditto-	Ponda(MCI)(31)	
W- 10		150	CIP	Khandpaband	GLR	300	65.00			-ditto-	Ponda(MCI)(31)	GL=82.0
W- 11		200	CIP		GLR	800	65.00			-ditto-	Ponda(MCI)(31), Queula(30), Bandora(CT)(29)	
W- 12		200	DIP	Kashi Matt	GLR	300	38.00			-ditto-	Bandora(CT)(29)	
W- 13		200	DIP	Fermagudi	GLR	800	80.00			-ditto-	Bandora(CT)(29), Queula(CT)(30)	GL=110.0
W- 14		200	DIP	Borim Baithakol	GLR	800	55.00			-ditto-	Borim(26), Queula(CT)(30)	
W- 15		200	DIP	Borim Paniwada (1991)	GLR	300	75.00			-ditto-	Borim(26)	
W- 16		80	CIP	Borim Paniwada (1975)	GLR	100	58.00			-ditto-	Borim(26)	
W- 17		200	DIP	Shiroda (2000)	GLR	800	45.00			-ditto-	Siroda(27)	
W- 18		200	DIP	Shiroda (1980)	GLR	300	45.00			-ditto-	Siroda(27)	
W- 19		100	CIP	Curti (Middle Quarter)	GLR	150	80.00	83.00		-ditto-	Codar(23), Canddepar(14)	
				Sub-Total		**9,350**						
R- 1	Red Line	150	CIP	Keriyem	GLR	300	65.00			Ponda	Candepar(14), Usgao(13), Vagurbem(11)	
R- 2		200	CIP	Usago	GLR	800	52.00			-ditto-	Usgao(13),	
										Sanguem	Piliem(1)	
R- 3		200	CIP	Near MRF Factory	OHR	50	38.00		53.00	Ponda	Usgao(13),	
R- 4		150	CIP	Usago Forest Area	OHR	150	50.00		65.00	-ditto-	Usgao(13),	GL=63.0, Not in use
R- 5		150	CIP	Curti	GLR	300	42.00			-ditto-	Curti(32)	
R- 6		150	CIP	Apewal (1991)	GLR	300	50.00			-ditto-	Priol(15), Querim(10)	w/Pump-1unit×3hrs/d
R- 7		250	CIP	Military Ponda	GLR	400	75.00			-ditto-	Curti(32)	
R- 8		150	CIP	Bhoot Khamb Keri	GLR	200	160.00			-ditto-	Querim(10), Savoi-Verem(6)	GL=156.0
R- 9		200	DIP	Ganga Nagar Ponda (1999)	GLR	800	70.00			-ditto-	Curti(32)	
R- 10		100	CIP	Simepain	GLR	75	45.00			-ditto-	Velinga(16)	
R- 11		150	CIP	Madkai	GLR	300	45.00			-ditto-	Marcaim(18)	
		225	HDPE									
R- 12		150	CIP	Mardol	GLR	300	45.00			-ditto-	Priol(15), Velinga(16)	
R- 13		200	CIP	Kundaim Near IDC Gate	GLR	300	40.00			-ditto-	Cundaim(17), Cumcolem(9), Boma(8)	

Table M31.2.7 List of Reservoirs for the Opa Water Supply Scheme (2/3)

Series No.	System	Tapping Main		Name of GLR / OHR / Sump (Name of Location)	Type	GLR/OHR/Sump				Supply Area		Remarks
		Dia. (mm)	Material			Capacity (m3)	Elevation (m)			Taluka	Village Name	
							RL	HWL	LWL			
R- 14	Red Line	150	CIP	Kundaim Near Kundil	GLR	200	78.00			-ditto-	Boma(8):Industry	
R- 15		150	CIP	Voila Wada	Sump	65	67.00			-ditto-	Boma(8):Industry	GL=67.0
R- 16		150	CIP	Adcona	Sump	32	45.00			-ditto-	Adcolna(7)	
R- 17		150	CIP	Tivrem	GLR	150	42.00			-ditto-	Tivrem(3), Orgao(2)	
R- 18		150	CIP	Wadiwada Betqui	GLR	300	44.00			-ditto-	Betqui(4), Candola(1)	
R- 19					Sump	25	40.00			-ditto-	Betqui(4)	w/Pump-1unit×5hrs/d
R- 20		150	CIP	Betqui Near Health Center	Sump	50	75.00			-ditto-	Betqui(4)	GL=87.0
R- 21		150	CIP	Betqui	GLR	100	55.00			-ditto-	Betqui(4)	GL=58.0
R- 22		150	CIP	Marcel (1975)	GLR	300	40.25			-ditto-	Tivrem(3)	
R- 23		150	CIP	Cumbharjua (1992)	OHR	150	23.00		40.00	Tiswadi	Cumbarjua(10), Gandaulim(11)	
R- 24		150	ACP	St. Estavam (1990)	GLR	300	47.91			-ditto-	Jua(9)	
R- 25		100	CIP	Ameywada (1975)	GLR	150	40.00			Ponda	Candola(1)	
R- 26		150	CIP	Corlim	GLR	150	30.00	33.80		Tiswadi	Corlim(12)	
R- 27		150	CIP	Carambolim (2004)	GLR	300	37.00	40.80		-ditto-	Carambolim(17)	
R- 28		150	CIP	Mallar - Diwar	GLR	300	51.00	54.80		-ditto-	Navelim(5), Goltim(6), Malar(7), Naroa(8)	
R- 29		150	CIP	St. Mathais Diwar	GLR	300	50.00			-ditto-	Navelim(5), Goltim(6), Malar(7), Naroa(8)	GL=50.0, Not in use
R- 30		100	ACP	Carambolim Peth	GLR	300	50.00	53.80		-ditto-	Carambolim(17)	
R- 31		100	ACP	Dongri Neura	GLR	300	42.00	45.80		-ditto-	Neura-O-Pequeno(24), Neura-O-Grande(25)	
R- 32		100	ACP	Mandur (1975)	GLR	150	32.00	35.80		-ditto-	Azossim(18), Mandur(19)	
R- 33		200	ACP	Pillar	GLR	800	40.00	43.80		-ditto-	Azossim(18), Neura-O-Pequeno(24), Neura-O-Grande(25), Mercurim(26), Goa Velha(37)	
R- 34		150	CIP	Old Goa (1985)	GLR	800	49.00	52.80		-ditto-	Gandaulim(11), Ella(13), Bainguinim(14)	
R- 35		150	CIP	Old Goa (1965)	GLR	300	56.00	59.80		-ditto-	Not in Use	
R- 36		150	CIP	Riabandar (1975)	GLR	150	55.00	58.80		-ditto-	Panelim (OG)-Ward(29)	
R- 37		150	CIP	Riabandar (1994)	GLR	300	55.00	58.80		-ditto-	Panelim (OG)-Ward(29)	
R- 38		150	CIP	Riabandar	OHR	650	55.00			-ditto-	Panelim (OG)-Ward(29)	
R- 39		150	CIP	Chimbel	GLR	300	58.00	61.80		-ditto-	Chimbel(CT)(27)	
R- 40		150	CIP	Merces	GLR	300	12.00	15.80		-ditto-	Morambi-O-Grande(Merces)(OG)(30), Renovadi(OG)-Ward No. 19(31), Morambi-O-Pequeno(Merces)(OG)-Ward No.20(32)	w/Pump-1unit×8hrs/d
				Sub-Total		**11,497**						

Table M31.2.7 List of Reservoirs for the Opa Water Supply Scheme (3/3)

Series No.	System	Tapping Main		Name of GLR / OHR / Sump (Name of Location)	Type	GLR/OHR/Sump				Supply Area		Remarks
		Dia. (mm)	Material			Capacity (m3)	Elevation (m)			Taluka	Village Name	
							RL	HWL	LWL			
G- 1	Green	150	CIP	Fermagudi	GLR	800	85.00	80.00		Ponda	Bandora(CT)(29), Queula(CT)(30)	
G- 2	Line	150	CIP		GLR	300	82.00	80.00		-ditto-	Bandora(CT)(29)	w/Pump-1unit×4hrs/d
G- 3		400	CIP	Bambolim	GLR	100	57.00	60.80		Tiswadi	Cujira(OG)-Ward No.21(33), Murda(OG)-Ward(34), Calapor(CT)(35),	
G- 4		400	CIP		GLR	800	57.00	60.80		-ditto-	Bamblim(CT)(36)	w/Pump-1unit×8hrs/d
G- 5		250	CIP	GMC Complex, Bambolim	OHR	650	73.00	77.00		-ditto-	Bamblim(CT)(36)	
G- 6				Curca	GLR	300	40.00	43.80		-ditto-	Curca(22)	
G- 7		250	CIP	Siridao	GLR	300	55.00	58.80		-ditto-	Siridao(23), Goa Velha(CT)(37)	
G- 8		500	CIP	Taligao	GLR	800	42.00	46.00		-ditto-		
G- 9		500	CIP		GLR	800	42.00	46.00		-ditto-		w/Pump-1unit×2hrs/d
G- 10		500	CIP		OHR	650	46.00	72.00		-ditto-		
G- 11		250	CIP	Nagali	Sump	50	43.00			-ditto-		w/Pump
G- 12					OHR	150	55.00	76.00		-ditto-		
G- 13		500	CIP	Altinho (1960) - R6	OHR	450	60.00	82.00		-ditto-		
G- 14				Altinho - R1	GLR	800	59.00	63.00		-ditto-	Panaji(M C+OG)(28)	w/Pump Pumping to OHR
G- 15				Altinho - R2	GLR	800	59.00	63.00		-ditto-		
G- 16				Altinho - R3	GLR	800	59.00	63.00		-ditto-		w/Pump Pumping to OHR
G- 17				Altinho - R4	GLR	800	59.00	63.00		-ditto-		
G- 18				Altinho - R5	GLR	800	59.00	63.00		-ditto-		
G- 19				Altinho - R7	OHR	650	59.00	85.00		-ditto-		
G- 20				Altinho - R8	GLR	5,000	59.00	64.00		-ditto-		
G- 21				CABO (Ras Bhavan)	GLR	800	45.00	48.80		-ditto-		
				Sub-Total		**15,800**						
				Total		**60,462**						
				Retention Time		**11.0 hrs**						

Note: RL=Reduced Level, GL=Ground Level, HWL=High Water Level in Reservoir, LWL=Low Water Level in Reservoir, GLR=Ground Level Reservoir, OHR=Over Head Reservoir, Sump=Pumping Suction Well, MBR=Master Balancing Reservoir

M31.3 Chandel Water Supply Scheme

The Chandel facility consists of a 15 MLD plant commissioned in 2002. Raw water is sourced from the Kalana River which is pumped approximately 150m to the plant. The site contains a clear water sump from which water is pumped to the MBR approximately 800m away for onward gravity feed to the distribution system. We understand that prior to commissioning of the plant, a number of rural water supply schemes were in operation and the networks for these schemes are now interconnected with the Chandel plant. We understand that the rural schemes serve to augment the regional scheme at peak demand times.

Table M31.3.1 lists the summary of asset data for the WTP and Table M31.3.2 contains detailed asset data for the WTP. The plant schematic is shown on Figure M31.3.1.

The raw water pump house and treatment plant are located in separate compounds. The study team found these compounds to be adequately gated, fenced and secured by 24 hour on-site security personnel. The plant is manually operated. The plant operates 24 hours a day, and using a three shift system. The distribution network currently needs to be enhanced, therefore the plant operates at only 8.5 MLD.

Raw water supplied to the plant is measured at the par shall flume. This flume has a working flow measuring device. Flow measurement devices are not installed at the MBR or beyond. Therefore, transmission via the clean water reservoirs is estimated based on pump design capacities and hours of operation. The raw water pump house has four pumps (two duty) each with a capacity of 200 l/s. Maintenance standards are good and the drive couplings/shafts are well guarded.

Maintenance is generally reactive, except for regular oiling and greasing. There is no operation and maintenance manual (although some equipment catalogues are available) and training for new staff is only provided on the job by existing experienced staff. There are no written or formal safety systems for plant operation.

The treatment plant is controlled manually. Most equipment appears to be in good working order, except for the alum and lime mixers. The lime mixers were not functioning at the time of the site visit, which meant lime was added by hand at the flash mixer point. Generally, good maintenance standards are evident and the water pumps are well guarding. Currently there are no logs maintained at the plant.

The plant does not have an on-site laboratory, although equipment for measuring residual chlorine and pH levels is available. Residual chlorine and pH are measured hourly by the plant operators to inform the process control, however records of the measurements are not kept. Staff from the Panaji laboratory visit the site and take samples for analysis once a week.

Gas chlorination is used to disinfect the water. Chlorination is achieved using one tonne cylinders. Normally there is one cylinder in the chlorine house at any one time. There is only one vacuum type chlorinator, meaning there are no standby chlorinators. The study team was advised that another chlorinator will be installed. Maintenance of the chlorinator is undertaken in-house, but periodic calibration is not undertaken and no maintenance records are kept. No spare parts for the chlorine facility are kept on-site. Maintenance, installation standards and operation practices for chlorination are poor. Ammonia solution is used to detect leaks from the pipes and the connection joints. The only facility to detect or contain gas leaks is an immersion tank, however it is not easily accessible during an emergency. The feeder pipe to the contact tanks is made of poor quality flexible plastic hose and it is unprotected. This is not safe and should be rectified immediately. Personal breathing apparatus is not provided and staff are not aware of the safety procedures / measures required during the chlorination process.

Table M31.3.3 and Figures M31.3.2 show the data on monthly water quality at Chandel Water Treatment Plant. Table M31.3.4 shows a list of existing reservoirs for Chandel Water Supply Scheme.

Table M31.3.1 Summary of Asset Register of Chandel Water Treatment Plant

Name of Facility		Contents of Facility	Remarks
Raw Water Intake & Raw Water Transmission Facility	Jack Well & Connecting Pipe	^{D}9.0 m × ^{H}21.0m D600mm × CIP × 10.0m × 1 Line	Kalana River
	Pump & Motor	Vertical Turbine Self Water Lubricated Pump: ^{Q}417.6m^3/hr × ^{H}28.0m × 45kw × 4 units (2 – Standby)	Design Cap. of Intake Pump = 20MLD
	Raw Water Transmission Main	D400mm × 157m × CIP ×1 Line	
Treatment Facility	Aerator	Cascade Type: 1 unit	
	Parshal Flume & Flash Mixer	Each 1 unit (for Chemical Dosing)	
	Clariflocculator	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: ^{D}32.0m (Flocc. Zone 12.0m) × ^{WD}4.0m × 1 units Detention Period: Flocculation – 34.7min Clarifier – 3.5hrs [1)] Surface Loading for Clarifier: 27 m^3/m^2/d (18.8 mm/min) [2)]	1): 2～2.5 hrs 2): 30～40m^3/m^2/d
	Filter	Gravity Rapid Sand Filter Type ^{W}4.35m × ^{L}9.00m × 4 basins Effective Size of Sand:0.45～0.60mm, Depth of Sand: 0.60～0.70m Filter Area: 19.6 m^2/cell, 39.2 m^2/basin Filtration Rate: 5.0 m/hr [3)] (120 m/d) Air Scouring Rate: ??m/hr/cell [4)] (0.??m^3/min/m^2/cell) Backwash Rate: 10.2m/hr/cell [5)] (0.17m^3/min/m^2/cell)	Based on Specifications of Air Blower & Backwash Pump 3): 4.8～6.0m/hr 4): 36～54m/hr 5): 24～36m/hr
Clear Water Facility	Clear Water Reservoir	^{W}20.5m × ^{L}13.0m × ^{WD}3.0m × 1 unit Total Volume=800 m^3 Retention Time: 1.3 hr	
Chemical Feeding Facility	Alum Feeding Facility	Dry Aluminum Sulfate Solution Tank: 2 units	
	Lime Feeding Facility	Powder Lime Solution Tank: 2 units	
	Disinfection Facility	Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 2 units	
Laboratory	Frequency of Sampling & Analysis	Not In-Service, Jar Test: Not in Service Daily test: pH, Turbidity, R-Cl	
Clear Water Transmission Facility	Transmission Pump & Motor	Horizontal Centrifugal Pump: ^{Q}360m^3/hr × ^{H}115m × 179kw × 4 units (2 – Standby)	Design Cap. of Pump = 17MLD
	Rising Main	D400mm × DIP × 775m × 1 Line	
	Clear Water Reservoir (MBR)	^{W}20.0m × ^{L}20.0m × ^{WD}4.0m × 1 unit Total Volume=1,600 m^3	
Note: 1) ～ 4) are referring to "Manual on Water Supply and Treatment, Third Edition – Revised and Updated, May 1999"			

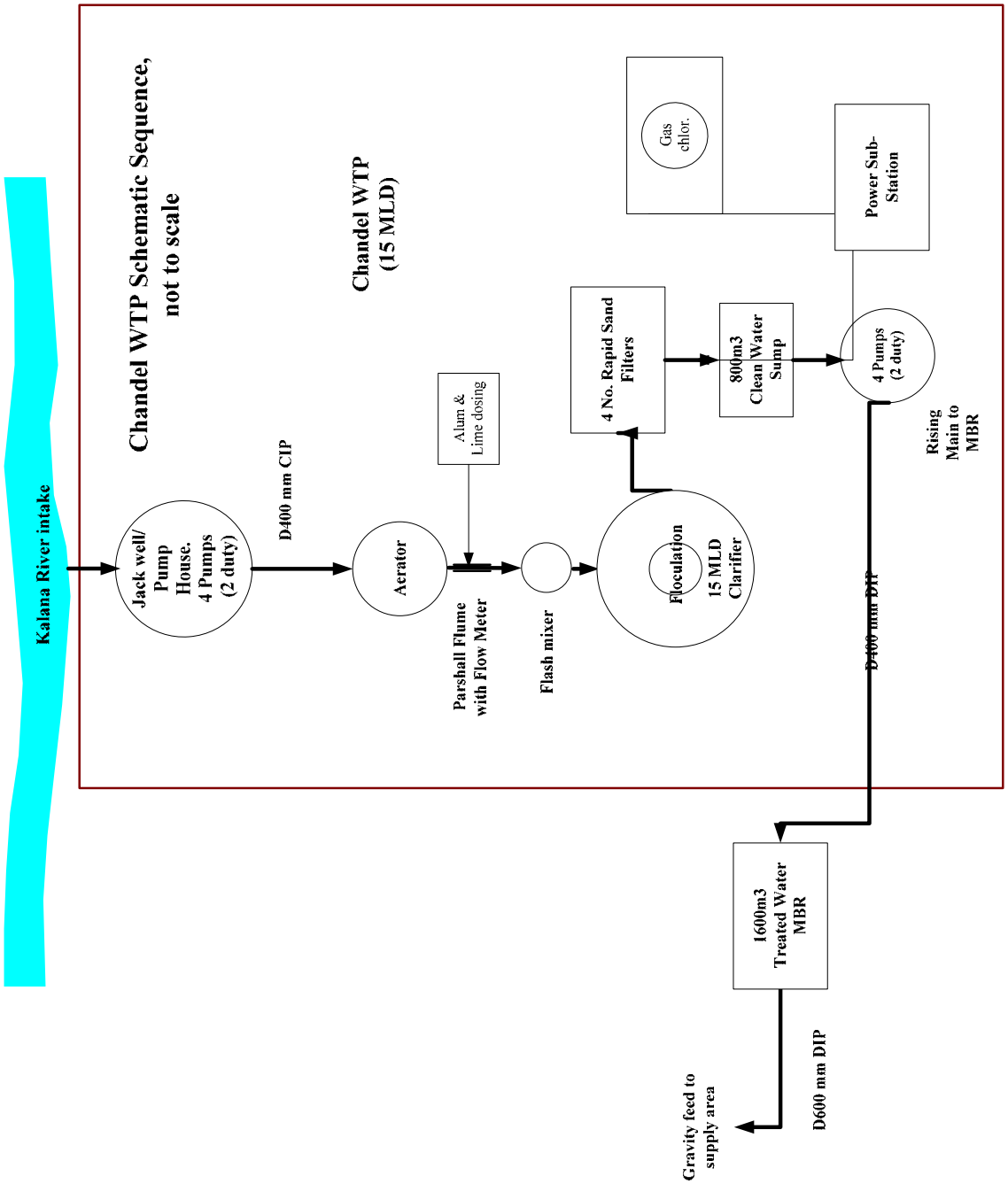

Figure M31.3.1 Schematic Sequence of Chandel Water Treatment Plant

Table M31.3.2 Present Conditions of Chandel Water Treatment Plant (1/5)

Item				Contents	Remarks
Background					
Covered Area for Water Supply			Taluka	Pernem	
Name of Plant				Chandel W.T.P.	
Number of W.T.P.			Number	(1)	
Capacity of Plant			MLD	15	
			m^3/d	15,000	
Raw Water Resources			River	Kalana	
			Dam		
Year of Construction			Year	2001-2002	
Year of Commission			Year	2002	
Expected Augmentation Plan (Tillari Irrigation Project)				35 MLD	

Name of Facility				Contents of Facility	Remarks
Capacity of Raw Water Intake & Water Treatment Plant			MLD	18.75	: 25% Losses of Nominal Capacity
			m^3/d	18,750	
Head Water Works : Raw Water Intake					
Intake Well	Diameter		m	6.00	
	Height		m	5.00	
	Water Depth		m	?	
	Volume		m^3/unit	0.0	
	Water Level of River				
		H.W.L.	m	?	
		L.W.L	m	?	
Connecting Pipe	Diameter		mm	600	
	Length		m	10.00	
	Material			CIP	
	Velocity		m/sec	0.768	
	Loss of Head		m	0.013	: Hazen-Williams Formula
Jack Well & Pump House	Diameter		m	9.00	
	Height		m	21.00	
	Water Depth		m	?	
	Volume		m^3/unit	0	
	Detension Time		min	0.00	
Control Room	Width		m	6.00	
	Length		m	6.00	
	Area of Floor		m^2	36.00	
Raw Water Pump	Capacity		ℓ/sec	116	
			m^3/min	6.96	
			m^3/hr	417.6	
			m^3/d	10,022	
	Number		unit	4	
		Stand-by	unit	2	
	Total Capacity		m^3/d	20,000	OK
	Head		m	28.0	
	Maker			WPIL Ltd.	
	Year of Manufacture			2002	
	Assessment of Condition			Working	
Raw Water Motor	Motor Output		HP	60	
			kW	45	
	Number		Unit	4	
	Maker			Kirlosker	
	Year of Manufacture			2002	
	Assessment of Condition			Working	
Raw Water Transmission Line	Diameter		mm	400	
	Length		m	157	
	Material			CIP "B"	
	Velocity		m/sec	0.543	
	Loss of Head		m	1.438	: Hazen-Williams Formula
	Assessment of Condition		Pipe	Good	
			Valve	Good	

Table M31.3.2 Present Conditions of Chandel Water Treatment Plant (2/5)

Item				Contents		Remarks
Water Treatment Plant						
	Aerator	Capacity	m^3/hr	781.3	625	: Answer to Questionnare
			m^3/d	18,750	15,000	
		Number	Unit	1		
		Diameter	m	9.0		
		Height	m	?		
		El. of Top Aerator	m	?		
		Assessment of Condition		Good		
	Parshal Flume / Weir	Number	Unit	1		
		Assessment of Condition		Good		
	Flash Mixer	Number	Unit	1		
		Assessment of Condition		Good		
	Clarifiers / Settling Tank (Coagulation Basin)	Dsign Capacity	m^3/min/unit	13.0		
			m^3/hr/unit	781.3		
			m^3/d/unit	18,750		
		Number	Unit	1		
		Water Depth	m	4.00		
		Overall Diameter	m	32.00		
		Flocc. Zone Dia.	m	12.00		
		Frequency of Desludging		General Season: 1 Time/48 hrs		
				Monsoon Season: 1 Time/24 hrs		
		Volume				
		Overall	m^3/unit	3,217.0		
		Flocculation Zone	m^3/unit	452.4		
		Clarifying Zone	m^3/unit	2,764.6		
		Retention Time				
		Flocculation Zone	min	34.7		OK
		Clarifying Zone	min	212.3		OK
		Overall	min	247.1		
		Surface Area	m^2/unit	691.2		
		Surface Loading	mm/min	18.8		Ok
		W.L. of Clarifier	m	?		
		Assessment of Condition		Working Condition		
	Flocculator & Drive Arrangement	Number	unit	1		
		Assessment of Condition				
				Working Condition		
	Filter	Design Capacity	m^3/hr/unit	195.3		
			m^3/d/unit	4,687.5		
		Number	Unit	4		
		Type		Rapid Sand Gravity Filter		
		Width	m	4.35		
		Length	m	9.00		
		Height	m	?		
		Water Depth	m	2.15		
		Filtered Area	m^2/unit	39.2		
		Velocity	$m^3/d/m^2$	119.7 OK		
		Filter Media		Standard Size		
		E.S. of Sand	mm	0.45～0.60		: E.S. = Effective Size
		Depth of Sand	mm	600～700		: U. C. E. = 1.3～1.7
		Type of Underdrain System		CIP with Header Tee		
		Year Replacement of Media		No Replacement		
		Water Level of Filter	m	?		
		Assessment of Condition		Working Condition		
	Filter Washing Criteria & Method	Air Scouring Rate	$m^3/min/m^2$			
		Air Scouring Time	min	5		
		Backwash Rate	$m^3/min/m^2$	0.34	NO	
		Backwashing Time	min	15～20		
		Frequency of Washing		General : 1 Time/72 hrs		
				Maximum : 1 Time/24 hrs		

Table M31.3.2 Present Conditions of Chandel Water Treatment Plant (3/5)

Name of Facility				Contents of Facility			Remarks
	Backwash Pump & Motor	Capacity	m^3/min	6.71			
			m^3/hr	402.77			
		Number	unit	2			
		Stand-by	unit	1			
		Total Capacity	m^3/min	6.71			
		Head	m	12.0			
		Type of Pump		Centrifugal			
		Motor Output	HP	100			
			kW	75			
		Assessment of Condition		Working			
	Air Blower	Capacity	m^3/min				
			m^3/hr				
			m^3/d				
		Number	unit				
		Stand-by	unit				
		Total Capacity	m^3/min				
			m^3/d				
		Head	mm WG				
		Motor Output	HP	40.0			
			kW	30.0			
		Assessment of Condition		Working			
	Clear Water Reservoir (Sump)	Width	m	20.5			
		Length	m	13.0			
		Water Depth	m	3.0			
		Number	Unit	1			
		Volume	m^3	800			
		Total	m^3	800			
		Detention Time	hr	1.3			
		Last Date of Cleaning		Pediodical			
		Water Level	m	12.70			
				10.00			
		Assessment of Condition		Working			
Chemical Facility							
	Alum Feeding Facility	Capacity	kg/hr				
			m^3/unit	9.2			
		Diameter	m				: + T.C.L. Tank 8 m3 ?
		Width	m				
		Length	m				
		Height	m				
		Volume	m^3				
		Number	Unit	2			
		Stand-by					
		Assessment of Condition		Working			
	Lime Feeding Facility	Capacity	kg/hr				
			m^3/unit	27.0			
		Diameter	m				: + T.C.L. Tank 8 m3 ?
		Width	m				
		Length	m				
		Height	m				
		Volume	m^3				
		Number	Unit	4			
		Stand-by					
		Assessment of Condition		Working			
	Disinfection System	Chemical Used		Liquid Chlorine			
		Type of Plant & Machinery		Vaccum Type			: Pnwatt ?
		Capacity	kg/hr				
		Number	Unit	2			
		Stand-by					
		Safty Measures Taken		-			
		Commissioned		2002			
		Assessment of Condition		Working			

Table M31.3.2 Present Conditions of Chandel Water Treatment Plant (4/5)

Name of Facility				Contents of Facility			Remarks
Laboratory							
Chemical Testing Laboratory				Not in-service			?
Jar Testing				-			
Availability of Skilled Chemists				-			
Availability of Required Chemicals				From Assonora Store			
							: ? month store
Use of Test Reports				As per Format			
Frequency of Sampling & Analysis				20 Parameters Tests Fortnightly			
				Daily Test: Turb., pH, R-CL			
General Quality of Water				Treatable with Water Treatment Process			
	Raw Water Quality			Turbid., Low pH			
	Clear Water Quality			Excellent			
Transformers							
Number of Transformer				(1)	(2)		
Pole Mounted / Pad Mounted				Floor	Floor		
Capacity			kVA	630	630		
Number			Unit				
Standby							
Commissioned				2002	2002		
Likely Design Life			Year	30	30		
Last Replacement				-	-		
Assessment of Condition				Good	Good		
Equipment Status							
Flow Meters				No Flow Meters			
Other Operating Valves				Working			
Other Important Assets							
Valve's Condition				Working Condition			
Visible Leakage and Locations							
Building Condition				Good			
Wastewater Disposal Arrangements				Sludge Chamber with Disposal			
Transmission (Clear Water) Facility							
Transmission (Clear Water) Pump	Capacity		ℓ/sec	100			
			m^3/min	6.00			
			m^3/hr	360.0			
			m^3/d	8,640			
	Number		unit	4			
	Stand-by			2			
	Total Capacity		m^3/d	17,000			
	Head		m	115.0			
	Type of Pump			Vertical			
	Maker			Kirlosker			
	Year of Manufacture			2002			
	Assessment of Condition		Pump	Working Condition			
			Valve	Working Condition			
Transmission (Clear Water) Motor	Motor Output		HP	240			
			kW	179			
	Number		Unit	4			
	Maker			Crompton			
	Year of Manufacture			2002			
	Assessment of Condition			Working Condition			
Raising Main (Transmission Lines)	Diameter		mm	400			
	Length		m	775			
	Material			DIP (K-9)			
	Velocity		m/sec	1.382			
	Loss of Head		m	4.698			: Hazen-Williams Formula
	Assessment of Condition		Pipe	Working			
			Valve	Working			

Table M31.3.2 Present Conditions of Chandel Water Treatment Plant (5/5)

Name of Facility				Contents of Facility			Remarks
	Master Balancing Reservoir (M.B.R.)	Width	m	20.00			
		Length	m	20.00			
		Water Depth	m	4.00			
		Number	Unit	1			
		Volume	m^3	1,600			
		Total	m^3	1,600			
		Detention Time	hr	2.6			
		Last Date of Cleaning		Pediodical			
		Water Level	m	104.00	: Inlet		
				100.00			
		Assessment of Condition		Working			

Present Condition of Chandel Water Treatment Plant N0.3

Organization & Staff Deployed							
General Shift	Working Hour :	05:00 → 19:00 (12:30 → 13.30 : Lunch Time)					
		Night Duty : 16:00 ～ 09:00 : 8 Persons					
Shift in Plant Operation	Shifting System	2 Shifting System Covering 24 Hours					
	Working Hour :	①: 08:00 → 20:00 , ②: 20:00 → 08:00					
Staff Deployed at the Plant		Person	Qualification	Year of Service	Service at plant		
Management Staff - Engineers							
	Assistant Engineer	1	M.E.(P.H.E.)	20	2		
	Sub-total	1					
Skilled Staff - Operators / Quality Testing							
	Mechanics	2	I.T.I.	2	2		
	Electrician	2	I.T.I.	2	2		
	Operator	8	I.T.I.	2	2		
	Sub-total	12					
Unskilled Staff		17	- Helper, Sweeper, Security Guards				
Total Number		30					

Table M31.3.3 Monthly Water Qaulity of Chandel Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

	Color			Odor			Taste			Turbidity (NTU)			pH			Specific Conductivity (/u mhos/cm)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0			Unobjectable			Unobjectable			4.3	0.3		7.0	7.2		78.8	85.4	
Feb-03	0			Unobjectable			Unobjectable			3.2	0.8		7.1	7.2		86.0	96.7	
Mar-03	0			Unobjectable			Unobjectable			1.8	0.9		6.6	7.0		88.4	96.8	
Apr-03	0			Unobjectable			Unobjectable			5.0	1.2		6.7	7.0		96.2	99.8	
May-03	0			Unobjectable			Unobjectable			5.3	1.1		6.9	7.0		167.4	143.8	
Jun-03	5			Unobjectable			Unobjectable			23.4	1.0		6.7	6.4		50.7	61.8	
Jul-03	0			Unobjectable			Unobjectable			10.7	1.0		6.5	6.8		52.6	66.4	
Aug-03	0			Unobjectable			Unobjectable			14.5	0.6		7.0	7.2		55.9	77.3	
Sep-03	0			Unobjectable			Unobjectable			9.8	0.8		7.1	7.3		56.6	64.0	
Oct-03	0			Unobjectable			Unobjectable			6.0	0.8		7.1	7.3		58.5	69.5	
Nov-03	0			Unobjectable			Unobjectable			7.5	0.5	0.5	7.5	7.6	7.6	69.0	92.3	82.3
Dec-03	0			Unobjectable			Unobjectable			5.2	0.5	0.6	7.5	7.2	7.2	73.2	97.5	97.8
Jan-04	0		0	Unobjectable			Unobjectable			4.6	0.4	0.4	7.5	7.3	7.4	74.1	92.0	92.2
Feb-04	0		0	Unobjectable			Unobjectable			2.9	0.5	0.6	7.1	7.5	7.2	79.5	95.4	95.2
Mar-04	0	0	0	Unobjectable			Unobjectable			2.5	0.6	0.4	7.2	7.4	7.4	86.5	97.4	97.9
Apr-04	0	0	0	Unobjectable			Unobjectable			6.1	0.5	0.5	7.0	7.2	7.1	95.7	109.0	114.3
May-04	0	0	0	Unobjectable			Unobjectable			3.1	0.4	0.4	7.0	7.0	7.0	108.0	123.4	125.4
Jun-04	20	0	0	Unobjectable			Unobjectable			80.8	0.8	1.0	6.5	6.3	6.3	35.4	66.7	68.4
Jul-04	0	0	0	Unobjectable			Unobjectable			23.4	0.5	0.5	7.2	7.1	7.1	50.3	67.2	68.0
Aug-04	0	0	0	Unobjectable			Unobjectable			19.6	1.2	1.0	6.9	7.0	6.9	49.4	59.7	60.6
Sep-04	5	0	0	Unobjectable			Unobjectable			39.5	0.9	0.8	7.2	7.5	7.3	52.5	75.0	76.7
Oct-04	0	0	0	Unobjectable			Unobjectable			17.0	1.6	0.5	7.3	7.3	7.2	61.5	68.7	72.0
Nov-04	0	0	0	Unobjectable			Unobjectable			4.5	1.4	1.2	7.3	7.4	7.3	67.4	71.3	74.0
Dec-04	0	0	0	Unobjectable			Unobjectable			3.5	1.0	1.3	7.5	7.5	7.3	76.3	80.2	80.2
Jan-05	0	0	0	Unobjectable			Unobjectable			3.5	0.9	1.5	7.0	7.5	7.5	86.5	88.5	89.9
Feb-05	0	0	0	Unobjectable			Unobjectable			6.6	0.6	1.0	6.9	7.2	7.2	89.4	94.2	94.0
Mar-05	0	0	0	Unobjectable			Unobjectable			4.3	1.8	1.5	6.9	7.4	7.1	77.5	87.1	87.2
Apr-05	0	0	0	Unobjectable			Unobjectable			5.4	1.4	1.7	7.1	7.3	7.2	104.2	110.1	110.3
May-05	0	0	0	Unobjectable			Unobjectable			9.9	2.1	2.2	7.2	7.5	7.4	102.0	107.0	109.0
Max	20	0	0							80.8	2.1	2.2	7.5	7.6	7.6	167.4	143.8	125.4
Min	0	0	0	Unobjectable			Unobjectable			1.8	0.3	0.4	6.5	6.3	6.3	35.4	59.7	60.6
Average	1.0	0.0	0.0							11.5	0.9	0.6	7.1	7.2	4.7	76.9	87.7	58.5

	Total Solids (mg/L)			Total Dissolved Solids (TDS) (mg/L)			Suspended Solids (mg/L)			Total Hardness as $CaCO_3$ (TALK) (mg/L)			Ca^{2+} (mg/L)			Mg^{2+} (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	53.0	54.0		51.0	54.0		2.0			29.0	32.0		7.2	8.4		2.8	2.8	
Feb-03	56.0	52.0		55.0	62.0		1.0			30.0	34.0		8.8	10.4		2.0	2.0	
Mar-03	58.0	62.0		58.0	62.0					38.0	39.0		8.4	9.2		4.3	4.0	
Apr-03	64.0	64.0		62.0	64.0		2.0			35.0	37.0		9.2	10.0		3.0	3.0	
May-03	109.0	92.0		107.0	92.0		2.0			48.0	48.0		10.8	10.8		5.3	5.3	
Jun-03	41.0	39.0		33.0	39.0		8.0			20.0	25.0		3.6	5.6		27.5	2.8	
Jul-03	37.0	42.0		34.0	42.0		3.0			18.0	25.0		4.0	5.6		2.0	2.8	
Aug-03	41.0	50.0		36.0	50.0		5.0			23.0	33.0		4.0	8.4		3.3	3.0	
Sep-03	40.2	42.0		37.0	42.0		3.2			24.0	30.0		4.6	5.8		3.0	3.0	
Oct-03	40.0	44.0		38.0	44.0		2.0			25.0	33.0		5.2	8.4		3.0	3.0	
Nov-03	46.5	52.0	52.0	44.0	52.0	52.0	2.5	0.0	0.0	30.0	38.0	38.0	6.4	9.6	9.6	3.5	3.5	3.5
Dec-03	49.0	62.0	62.0	47.0	62.0	62.0	2.0	0.0	0.0	30.0	42.0	42.0	6.4	11.2	11.2	3.5	3.5	3.5
Jan-04	49.0	58.0	58.0	47.0	58.0	58.0	2.0	0.0	0.0	30.0	38.0	38.0	7.2	10.0	10.0	3.0	3.3	3.3
Feb-04	51.0	61.0	61.0	50.0	61.0	61.0	1.0	0.0	0.0	34.0	40.0	40.0	8.4	10.8	10.8	3.3	3.3	3.3
Mar-04	56.5	62.0	62.0	56.5	62.0	62.0	0.5	0.0	0.0	35.0	41.0	41.0	8.8	11.2	11.2	3.3	3.3	3.3
Apr-04	63.5	70.0	73.0	61.0	70.0	73.0	2.5	0.0	0.0	37.0	46.0	48.0	9.6	11.2	12.0	3.3	4.5	4.5
May-04	70.0	79.0	80.0	69.0	79.0	80.0	1.0	0.0	0.0	45.0	54.0	54.0	11.6	14.0	14.0	4.0	4.8	4.8
Jun-04	49.0	42.5	44.0	23.0	42.5	44.0	26.0	0.0	0.0	13.0	26.0	30.0	3.2	6.4	7.6	1.3	2.5	2.8
Jul-04	38.0	43.0	43.5	32.0	43.0	43.5	6.0	0.0	0.0	18.0	23.0	23.0	4.4	6.0	6.0	1.7	2.0	2.0
Aug-04	37.0	38.0	38.5	32.0	38.0	38.5	5.0	0.0	0.0	18.0	24.0	24.0	4.8	6.4	6.4	1.5	2.0	2.0
Sep-04	43.0	48.0	49.0	33.5	48.0	49.0	9.5	0.0	0.0	19.0	33.0	33.0	5.2	8.8	8.8	1.5	2.8	2.8
Oct-04	43.5	44.0	46.0	39.0	44.0	46.0	4.5	0.0	0.0	24.0	2.0	26.0	5.6	6.0	6.0	2.5	2.8	2.8
Nov-04	44.5	46.0	47.0	43.0	46.0	47.0	1.5	0.0	0.0	27.0	29.0	29.0	6.4	6.8	6.8	2.8	3.0	3.0
Dec-04	49.0	51.0	51.0	48.0	51.0	51.0	1.0	0.0	0.0	30.0	32.0	32.0	8.4	8.8	8.8	2.3	2.5	2.5
Jan-05	56.5	56.5	57.0	55.5	56.5	57.0	1.0	0.0	0.0	3.8	39.0	39.0	8.0	8.8	8.8	4.5	4.3	4.3
Feb-05	58.0	60.0	60.0	57.0	60.0	60.0	1.0	0.0	0.0	40.0	42.0	42.0	9.2	10.0	10.0	4.3	4.3	4.3
Mar-05	51.0	55.5	55.5	49.5	55.5	55.5	1.5	0.0	0.0	31.0	36.0	36.0	7.2	9.2	9.2	3.3	3.3	3.3
Apr-05	68.5	70.0	70.0	67.0	70.0	70.0	1.5	0.0	0.0	47.0	49.0	49.0	11.2	11.6	11.6	4.8	5.0	5.0
May-05	68.5	68.0	69.0	65.0	68.0	69.0	3.5	0.0	0.0	46.0	49.0	49.0	10.0	11.6	11.6	5.3	5.0	5.0
Max	109.0	92.0	80.0	107.0	92.0	80.0	26.0	0.0	0.0	48.0	54.0	54.0	11.6	14.0	14.0	27.5	5.3	5.0
Min	37.0	38.0	38.5	23.0	38.0	38.5	0.5	0.0	0.0	3.8	2.0	23.0	3.2	5.6	6.0	1.3	2.0	2.0
Average	52.8	55.4	37.2	49.3	55.8	37.2	3.5	0.0	0.0	29.2	35.1	24.6	7.2	9.0	6.2	4.0	3.3	2.3

Table M31.3.3 Monthly Water Qaulity of Chandel Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

	Cl^- (mg/L)			Total Alkalinity as $CaCO_3$ (mg/L)			SO_4^- (mg/L)			Fe^{2+} (mg/L)			Mn^{2+} (mg/L)			NO_3^{2-} (mg/L)			$KMnO_4$ oxidizability as O_2 (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	6.0	6.0		29.0	29.0		0.0	0.0		0.4	0.05		0	0		0.6	0.0		0.3	0.0	
Feb-03	8.0	8.0		25.0	26.0		0.0	0.0		0.4	0.05		0	0		0.8	0.0		0.4	0.0	
Mar-03	6.0	6.0		40.0	41.0		0.0	0.0		0.1	0.05		0	0		0.4	0.0		0.2	0.0	
Apr-03	6.0	6.0		38.0	38.0		0.0	0.0		0.2	0.05		0	0		0.8	0.0		0.4	0.0	
May-03	22.0	16.0		54.0	52.0		0.0	0.0		0.3	0.06		0	0		0.8	0.0		0.4	0.0	
Jun-03	6.0	6.0		18.0	14.0		0.0	3.5		2.6	0.06		0	0		1.1	0.0		0.8	0.0	
Jul-03	6.0	6.0		20.0	19.0		0.0	4.5		2	0.05		0	0		1.7	0.0		0.4	0.0	
Aug-03	6.0	6.0		25.0	25.0		0.0	4.0		1.2	0.05		0	0		0.6	0.0		0.4	0.0	
Sep-03	6.0	6.0		27.0	28.0		0.0	4.0		1	0.05		0	0		0.7	0.0		0.3	0.0	
Oct-03	6.0	6.0		31.0	26.0		0.0	4.5		0.64	0.05		0	0		0.6	0.0		0.4	0.0	
Nov-03	6.0	6.0	6.0	33.0	38.0	38.0	0.0	7.5	7.5	0.5	0.05	0.05	0	0	0	0.8	0.0	0.0	0.4	0.0	0.0
Dec-03	6.0	6.0	6.0	33.0	38.0	35.0	0.0	0.0	0.0	0.7	0.05	0.05	0	0	0	1.2	0.0	0.0	0.4	0.0	0.0
Jan-04	6.0	6.0	6.0	34.0	31.0	32.0	0.0	6.5	6.5	0.6	0.05	0.05	0	0	0	1.6	0.0	0.0	0.5	0.0	0.0
Feb-04	6.0	8.0	8.0	38.0	41.0	41.0	0.0	0.0	0.0	0.4	0.05	0.05	0	0	0	1.0	0.0	0.0	0.4	0.0	0.0
Mar-04	7.0	7.0	7.0	40.0	42.0	42.0	0.0	0.0	0.0	0.4	0.06	0.06	0	0	0	0.8	0.0	0.0	0.3	0.0	0.0
Apr-04	8.0	8.0	8.0	45.0	47.0	46.0	0.0	0.0	0.0	0.55	0.06	0.06	0	0	0	1.0	0.0	0.0	0.6	0.0	0.0
May-04	7.0	7.0	7.0	45.0	42.0	42.0	0.0	0.0	0.0	0.4	0.05	0.05	0	0	0	0.6	0.0	0.0	0.3	0.0	0.0
Jun-04	5.0	5.0	7.0	14.0	27.0	3.0	0.0	0.0	0.0	4.8	0.1	0.1	0.12	0	0	2.5	0.0	0.0	1.6	0.0	0.0
Jul-04	6.0	6.0	7.0	19.0	23.0	23.0	0.0	0.0	0.0	1.6	0.06	0.06	0	0	0	1.2	0.0	0.0	0.8	0.0	0.0
Aug-04	6.0	6.0	6.0	24.0	25.0	25.0	0.0	0.0	0.0	1.5	0.1	0.1	0	0	0	1.0	0.0	0.0	0.8	0.0	0.0
Sep-04	5.0	5.0	7.0	24.0	35.0	34.0	0.0	0.0	0.0	1.9	0.06	0.06	0	0	0	1.3	0.0	0.0	0.9	0.0	0.0
Oct-04	6.0	6.0	7.0	28.0	28.0	28.0	0.0	0.0	0.0	0.6	0.1	0.06	0	0	0	0.8	0.0	0.0	0.6	0.0	0.0
Nov-04	6.0	6.0	8.0	28.0	29.0	29.0	0.0	0.0	0.0	0.25	0.1	0.1	0	0	0	0.2	0.0	0.0	0.3	0.0	0.0
Dec-04	6.0	6.0	6.0	32.0	33.0	33.0	0.0	0.0	0.0	0.3	0.1	0.1	0	0	0	0.2	0.0	0.0	0.2	0.0	0.0
Jan-05	7.0	7.0	8.0	37.0	37.0	37.0	0.0	0.0	0.0	0.35	0.06	0.06	0	0	0	0.3	0.0	0.0	0.2	0.0	0.0
Feb-05	7.0	7.0	7.0	41.0	43.0	43.0	0.0	0.0	0.0	0.2	0.06	0.06	0	0	0	0.6	0.0	0.0	0.3	0.0	0.0
Mar-05	9.0	9.0	9.0	33.0	35.0	35.0	0.0	0.0	0.0	0.35	0.1	0.1	0	0	0	0.6	0.0	0.0	0.3	0.0	0.0
Apr-05	9.0	9.0	9.0	45.0	48.0	48.0	0.0	0.0	0.0	0.4	0.1	0.1	0	0	0	0.6	0.0	0.0	0.4	0.0	0.0
May-05	8.0	7.0	9.0	42.0	39.0	39.0	0.0	0.0	0.0	0.65	0.1	0.1	0	0	0	1.1	0.0	0.0	0.6	0.0	0.0
Max	22.0	16.0	9.0	54.0	52.0	48.0	0.0	7.5	7.5	4.80	0.10	0.10	0.12	0.00	0.00	2.5	0.0	0.0	1.6	0.0	0.0
Min	5.0	5.0	6.0	14.0	14.0	3.0	0.0	0.0	0.0	0.10	0.05	0.05	0.00	0.00	0.00	0.2	0.0	0.0	0.2	0.0	0.0
Average	7.0	6.9	4.8	32.5	33.8	22.5	0.0	1.2	0.5	0.87	0.07	0.05	0.00	0.00	0.00	0.9	0.0	0.0	0.5	0.0	0.0

	BOD at 27°C and 3days (mg/L)			DO (mg/L)			F^- (mg/L)			Al^{3+} (mg/L)			Plate Count on nutrient agar no/100mL			MPN of Coliform no/100mL			MPN of E.Coli. no/100mL		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0.8	0.0					0.0	0.0					380	49	2	2400	460	0	210	93	0
Feb-03	1.0	0.0					0.0	0.0					338	47	4	1100	93	0	460	23	0
Mar-03	0.5	0.0					0.0	0.0					436	83	2	2400	460	0	1100	23	0
Apr-03	1.0	0.0					0.0	0.0		0	0		304	123	7	2400	240	0	1100	93	0
May-03	1.0	0.0					0.0	0.0		0	0		485	195	2	4600	460	0	2400	75	0
Jun-03	2.0	0.0					0.0	0.0		0	0.01		270	48	0	2400	240	0	1100	93	0
Jul-03	1.2	0.0					0.0	0.0		0	0		235	42	2	2400	240	0	1100	43	0
Aug-03	1.0	0.0					0.0	0.0		0	0.02		390	58	3	2400	240	0	460	43	0
Sep-03	0.8	0.0		7.2	7.4		0.0	0.0		0	0.02		196	96	2	2400	240	0	460	23	0
Oct-03	1.0	0.0					0.0	0.0		0	0.04		186	32	6	2400	150	0	460	43	0
Nov-03	1.0	0.0	0.0	7.2	7.3	7.4	0.0	0.0	0.0	0	0.03	0.03	132	23	0	1100	93	0	240	43	0
Dec-03	1.0	0.0	0.0	7.3	7.3	7.4	0.0	0.0	0.0	0	0.03	0.03	380	16	0	2400	150	0	460	39	0
Jan-04	1.2	0.0	0.0	7.2	7.5	7.5	0.0	0.0	0.0	0	0.01	0.01	213	47	3	2400	1100	0	240	210	0
Feb-04	0.8	0.0	0.0	7.2	7.4	7.4	0.0	0.0	0.0	0	0	0	151	28	0	1100	240	0	460	9	0
Mar-04	0.9	0.0	0.0	7.0	7.3	7.4	0.0	0.0	0.0	0	0	0	165	63	2	1100	240	0	93	93	0
Apr-04	1.2	0.0	0.0	6.9	7.3	7.3	0.0	0.0	0.0	0	0	0	260	71	3	2400	240	0	120	7	0
May-04	0.7	0.0	0.0	6.9	7.2	7.3	0.0	0.0	0.0	0	0	0	193	34	3	2400	240	0	460	93	0
Jun-04	3.5	0.0	0.0	6.7	7.2	7.2	0.0	0.0	0.0	0	0.01	0.01	480	108	2	4600	240	0	2400	43	0
Jul-04	1.8	0.0	0.0	6.8	7.2	7.2	0.0	0.0	0.0	0	0.01	0.01	218	32	0	2400	93	0	460	23	0
Aug-04	1.7	0.0	0.0	7.2	7.5	7.6	0.0	0.0	0.0	0	0.03	0.03	223	212	0	2400	240	0	240	21	0
Sep-04	2.0	0.0	0.0	7.3	7.5	7.5	0.0	0.0	0.0	0	0.01	0.01	288	110	1	4600	460	0	460	23	0
Oct-04	1.0	0.0	0.0	7.3	7.4	7.4	0.0	0.0	0.0	0	0.01	0.01	170	98	1	2400	150	0	1100	43	0
Nov-04	0.6	0.0	0.0	7.3	7.4	7.4	0.0	0.0	0.0	0	0.01	0.01	93	36	4	1100	120	0	210	39	0
Dec-04	0.5	0.0	0.0	7.3	7.4	7.4	0.0	0.0	0.0	0	0.04	0.04	136	24	0	1100	460	0	460	240	0
Jan-05	0.5	0.0	0.0	7.5	7.6	7.6	0.0	0.0	0.0	0	0	0	186	42	3	2400	240	0	240	28	0
Feb-05	0.5	0.0	0.0	7.3	7.5	7.5	0.0	0.0	0.0	0	0.05	0.05	178	47	4	2400	240	0	210	93	0
Mar-05	0.7	0.0	0.0	7.6	7.7	7.7	0.0	0.0	0.0	0	0	0	160	83	4	4600	240	0	2400	28	0
Apr-05	0.8	0.0	0.0	7.5	7.6	7.6	0.0	0.0	0.0	0	0	0	134	28	1	2400	46	0	210	28	0
May-05	1.5	0.0	0.0	6.8	7.3	7.3	0.0	0.0	0.0	0	0.13	0.13	280	50	1	2400	460	0	1100	150	0
Max	3.5	0.0	0.0	7.6	7.7	7.7	0.0	0.0	0.0	0.0	0.1	0.1	485	212	7	4600	1100	0	2400	240	0
Min	0.5	0.0	0.0	6.7	7.2	7.2	0.0	0.0	0.0	0.0	0.0	0.0	93	16	0	1100	46	0	93	7	0
Average	1.1	0.0	0.0	4.9	5.1	4.9	0.0	0.0	0.0	0.0	0.0	0.0	250.3	66.4	2.1	2434.5	279.8	0.0	703.9	62.2	0.0

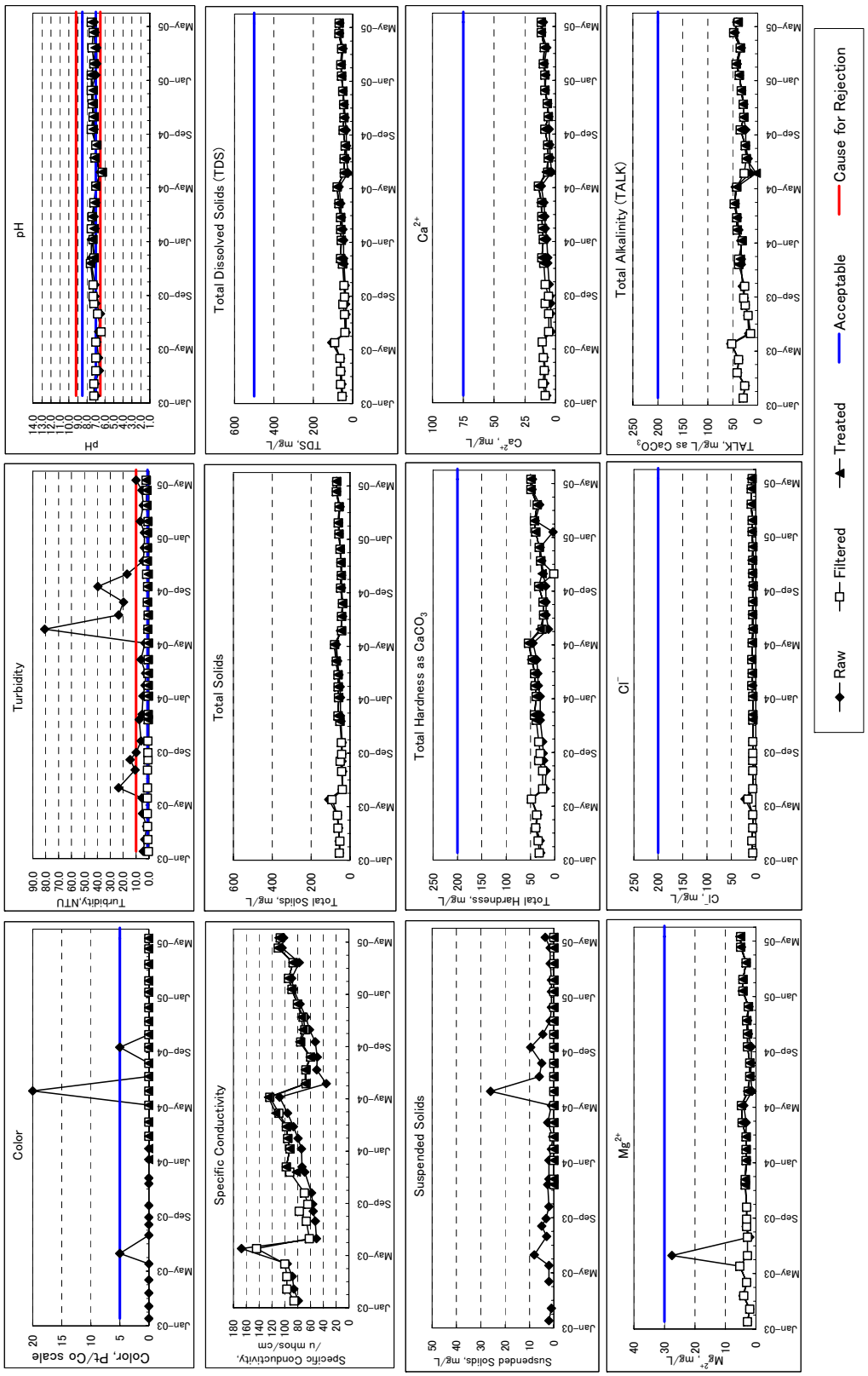

Figure M31.3.2 Monthly Water Qaulity of Chandel Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

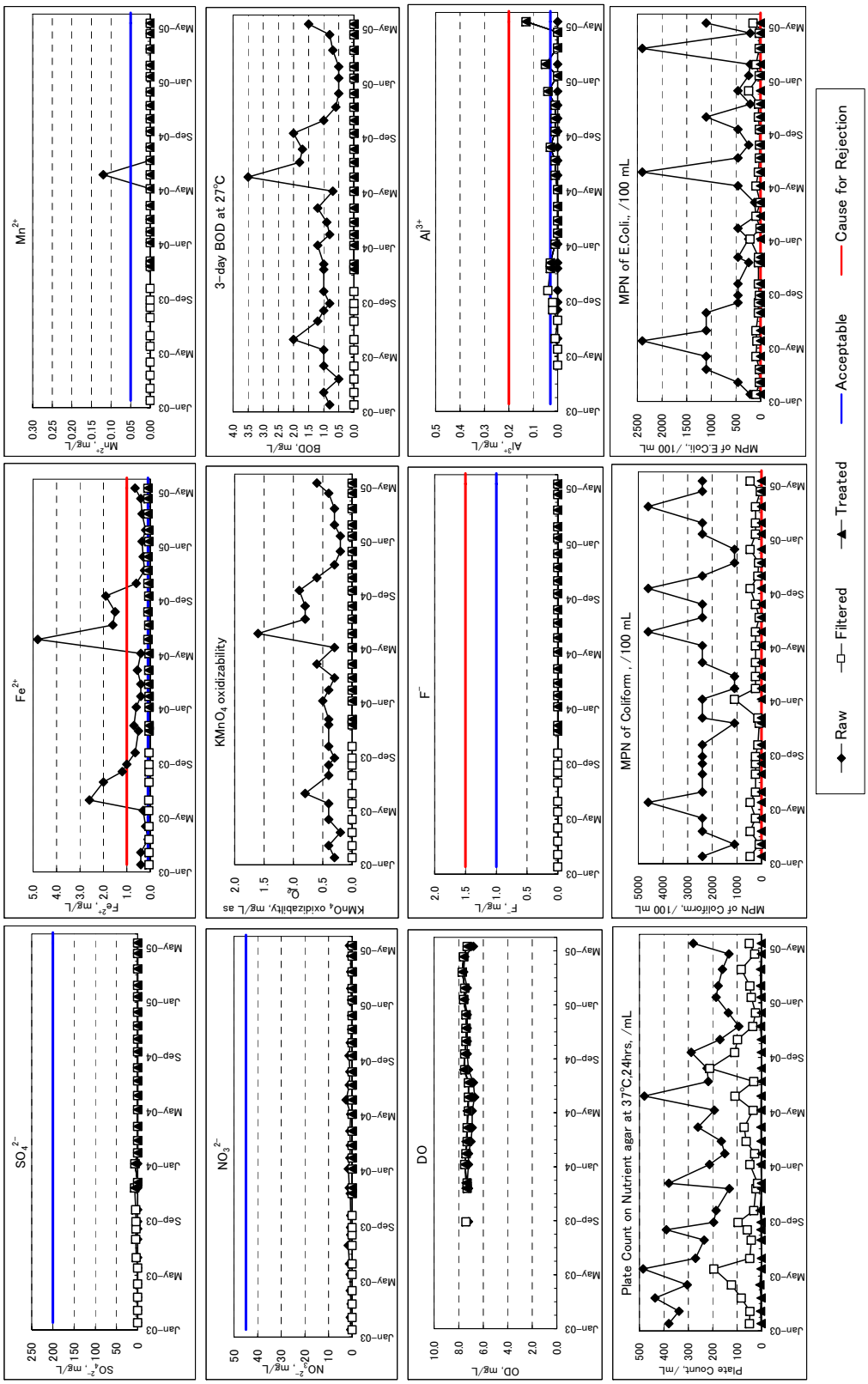

Figure M31.3.2 Monthly Water Qaulity of Chandel Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

Table M31.3.4 List of Reservoirs for the Chandel Water Supply Scheme

Serial No.	Inlet Pipe		Name of GLR / OHR (Name of Location)	Type	GLR/OHR				Supply Area (Village Name)	Remarks
	Dia. (mm)	Material			Capacity (m3)	Elevation (m)				
						RL	HWL	LWL		
1	400	DIP	Casarvarem MBR	GLR	1,600	100.00	104.00			Outlet:600CIP
2	100	DIP	Casarvarem	GLR	50	66.00	70.00		Casarvornem(18)	
3	100	DIP	Chandel	GLR	100	54.00	58.00		Chandel(15)	
4	100	PVC	Alorna	GLR	100	54.00	58.00		Alona(16)	
5	100	PVC	Ibrampur	GLR	100	54.00	58.00		Ibrampur(16)	
6	100	PVC	Ozari	GLR	100	71.00	75.00		Ozorim(19)	
7	100	PVC	Varcond	GLR	50	59.00	63.00		Varconda(9)	
8	100	PVC	Ambernem	GLR	100	54.00	58.00		Cancem(8), Amberem(10)	
9	100	PVC	Naibag	GLR	50	54.00	58.00		Poroscodem(7)	
10	100	DIP	Ugvem	GLR	100	54.00	58.00		Uguem(11)	
11	150	DIP	Tamboxem	GLR	100	54.00	58.00		Tamboxem(12)	
12	100	PVC	Torshem	GLR	50	54.00	58.00		Torxem(13)	
13	100	PVC	Patradevi	GLR	100	54.00	58.00		Torxem(13)	
14	200	DIP	Dhargal	GLR	800	44.00	48.00		Dargalim(20)	
15	100	PVC	Virnoda	GLR	70	54.00	58.00		Virnora(21)	
16	100	PVC		GLR	50	54.00	58.00			
17	200	DIP	Malpe	GLR	800	54.00	58.00		Pernem(M Cl)(27), Pernem(Rural)(6)	
18	150	DIP	Pernem	GLR	150	44.00	48.00		Pernem(M Cl)(27), Pernem(Rural)(6)	
19	150	DIP	Parastem	GLR	50	54.00	58.00		Pernem(M Cl)(27)	
20	150	DIP		GLR	100	54.00	58.00			
21	200	DIP	Tuem	GLR	50	55.00	59.00		Tuem(22)	
22	200	DIP		GLR	150	55.00	59.00			
23	200	DIP		GLR	400	55.00	59.00			
24	150	DIP	Parcem	GLR	70	54.00	58.00		Parcem(CT)(28)	
25	100	PVC	Agarwada	GLR	50	54.00	58.00		Chopdem(25), Agarvado(26)	
26	150	DIP	Morjim	GLR	100	54.00	58.00		Morgim(24)	
27	150	DIP		GLR	100	54.00	58.00			
28	150	DIP	Mandrem	GLR	100	54.00	58.00		Mandrem(23)	
29	150	DIP	Dandoswada	GLR	50	57.00	61.00		Mandrem(23)	
30	150	DIP	Korgao	GLR	70	60.00	64.00		Corgao(5)	
31	200	DIP	Kerim	GLR	150	44.00	48.00		Querim(2)	
32	200	DIP	Harmal	GLR	250	34.00	38.00		Arambol(4)	
33	150	DIP	Paliyem	GLR	70	67.00	71.00		Paliem(3)	
			Total		**6,230**					
			Detention Time		**10.0 hrs**					

Note: RL=Reduced Level (Base Elevation of Reservoir), HWL=High Water Level in Reservoir, LWL=Low Water Level in Reservoir, GLR=Ground Level Reservoir, OHR=Over Head Reservoir, MBR=Master Balancing Reservoir

M31.4 Assonora Water Supply Scheme

The Assonora facility consists of a 12 MLD plant commissioned in 1968 and a 30 MLD planned commissioned in 1992. The 12 MLD plant sources water from the Amthane Dam by gravity feed approximately 10 km from the plant as well as a supplementary supply from the Assonora River via a jack well. The river source supply line is interconnected with the 30 MLD plant to supplement the main incoming raw water supply from Podocem (20 km's away) which provides 25 MLD to the plant. The site also contains a clear water sump for the approximately 15 MLD treated water received from Podocem WTP for onward distribution to the Assonora supply area.

We understand that a proposal for an additional 40 MLD plant has been prepared and submitted to PWD for approval.

Table M31.4.1 lists the summary of asset data for the WTP and Table M31.4.2 contains detailed asset data for the WTP. The plant schematic is shown on Figure M31.4.1.

The raw water pump house and the treatment plant are located within the same compound. The compound is adequately gated, fenced and secured by 24 hour on-site security personnel. The plant is manually operated and operates for 24 hours a day, using a three shift system.

Flow measurement devices are not installed. Therefore, raw water supplied to the plant (from the dam, river and Podocem), clean water fed to the plant from the Podocem WTP, and onward transmission via the clean water reservoir was estimated using pump design capacities and pump operating hours.

The raw water pump house has three pumps (one duty) each of 15 MLD capacity. Maintenance standards are good, however the drive couplings/shafts are not adequately guarded.

Records of pumping hours, loads etc are logged, however maintenance records are not kept. Maintenance is generally reactive to rectify problems as they become apparent, except for oiling and greasing which is undertaken regularly. There are no operation and maintenance manuals available and training for new staff is only provided on the job by existing experienced staff. There are no written or formal safety systems.

The treatment plants are manually controlled. Most equipment appears to be in good working

order (considering the age of the plant) except for the alum and lime mixers which do not work. Since the alum and lime mixers are out of service lime and alum are added by hand at the flash mixer point. Generally, good maintenance was evident and the treated water pumps were well guarding. This plant should be used as an example of good practice for the other sites.

Records of pump running hours, load, filter backwashing, and clear water reservoir levels are logged. However repairs to assets, maintenance and responses to breakdown problems are not recorded. The laboratory staff keep records of chemical usage and treatment parameters.

Disinfection is achieved using gas chlorination. Chlorination is achieved using one tonne cylinders. There are usually eight cylinders in the chlorine house at any one time (five are empty). There are four vacuum type chlorinators (two are for standby). Maintenance of the chlorinators is performed in-house, however periodic calibration of the chlorinators does not occur and records of maintenance are not kept.

Maintenance, installation standards and operation practices for chlorine use are poor. Ammonia solution is used as a means of detecting leaks along pipes and at the connection joints. Immersion tanks are the only facilities available to detect or contain gas leaks, however they are not easily accessible during an emergency and were empty when the study team visited the site.

During the site visit, flexible copper pipes were noted to be trailing on the platform, presenting a trip hazard and placing the pipes in danger of being damaged. This is not a safe practice. The feeder pipe to the contact tanks is PVC and unprotected, which is not a safe practice. Personal breathing apparatus is available in the laboratory but is not used or maintained. This facility is probably in the poorest condition of all the facilities visited and presents a serious health hazard.

The clean water reservoirs are cleaned every six months by PHE staff. There are no safety precautions, safety equipment, or safety systems implemented during the work. The cleaning procedure consists of removing the covers to provide fresh air to the workers and to allow the workers to enter. The desludging is undertaken manually by hosing/flushing down the internal surfaces.

Tables M31.4.3 and M31.4.4 and Figures M31.4.2 and M31.4.3 show the data on monthly water quality at Chandel Water Treatment Plant. Table M31.4.5 shows a list of existing reservoirs for Assonora Water Supply Scheme.

Table M31.4.1 Summary of Asset Register of Assonora Water Treatment Plant

Name of Facility		12 MLD		30 MLD	
		Contents of Facility	Remarks	Contents of Facility	Remarks
Raw Water Intake & Raw Water Transmission Facility	Intake Well & Connecting Pipe	D400mm × CIP × 1 Line,	Assonora River	D400mm (from 12 MLD Intake)	Assonora River
	Pump & Motor	Horizontal Centrifugal Pump: ^{O}625m^3/hr × ^{H}17.0m × 55kw × 3 units (2 - Standby)	Design Cap. of Intake Pump =15MLD	Vertical Pump: 700kw × 2 units	Valvant River
	Raw Water Transmission Main	D450mm × 10,000m × ACP ×1 Line	Amthane Dam	D600mm/D500mm ×^{L}20.12km×1 Line (25 MLD: from Podocem Intake),	Valvant River
Treatment Facility	Aerator	Cascade Type: 2 units		Cascade Type: 2 units	
	Flash Mixer & Weir / Parshal Flume	Weir×1 unit (for Chemical Dosing), Flash Mixer × 1 unit		Parshal Flume × 2 units (for Chemical Dosing), Flasha Mixer × 1 unit	
	Clariflocculator	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: ^{D}22.9m (Flocc. Zone ^{D} 10.2m) × ^{wD}3.75m × 1 unit Detention Period: Flocculation - 35min Clarifier – 2.4 hrs Surface Loading: 38.2 m^3/m^2/d (26.5 mm/min) [2]	1): 2～2.5 hrs 2): 30～40m^3/m^2/d	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: ^{D}41.2m (Flocc. Zone ^{D}18.4m) × ^{wD}4.0m × 1 unit Detention Period: Flocculation - 48min Clarifier – 3.2 hrs Surface Loading: 29.5 m^3/m^2/d (20.5 mm/min) [2]	1): 2～2.5 hrs 2): 30～40m^3/m^2/d
	Filter	Gravity Rapid Sand Filter Type ^{w}6.0m × ^{L}5.0m × 2cells/basin × 4 basins Effective Size of Sand: 0.60mm～0.80mm, Depth of Sand: 0.55m Filter Area: 15.0 m^2/cell, 30.0 m^2/basin Filtration Rate: 4.4 m/hr [3] (105 m/d) Air Scouring Rate: 39.6m/hr/cell [4] (0.66 m^3/min/m^2/cell) Backwash Rate: 26.4 m/hr/cell [5] (0.44 m^3/min/m^2/cell) – using 200m^3 Backwash Tank	Based on Specifications of Air Blower & Backwash Pump 3): 4.8～6.0m/hr 4): 36～54m/hr 5): 24～36m/hr	Gravity Rapid Sand Filter Type ^{w}4.0m × ^{L}8.6m × 2cells/basin × 6 basins Effective Size of Sand: 0.60mm～0.80mm, Depth of Sand: 0.75m Filter Area: 17.2 m^2/cell, 34.4 m^2/basin Filtration Rate: 6.4 m/hr [3] (153 m/d) Air Scouring Rate: 33.6m/hr/cell [4] (0.56 m^3/min/m^2/cell) Backwash Rate: 17.4 m/hr/cell [5] (0.29 m^3/min/m^2/cell)	Based on Specifications of Air Blower & Backwash Pump 3): 4.8～6.0m/hr 4): 36～54m/hr 5): 24～36m/hr
Chemical Feeding Facility	Alum Feeding Facility	Dry Aluminum Sulfate Solution Tank: 2 units		Dry Aluminum Sulfate Solution Tank: 2 units Using 12 MLD's Facility	Non-Function from Commisioning
	Lime Feeding Facility	Powder Lime, Solution Tank: 2 units, Non-Function from Commissioning Using Temporary Place under Aerator by Hand Carrying			
	Disinfection Facility	Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 4 unit (2 units for 12 MLD & 2 units for 30 MLD)			
Laboratory	Frequency of Sampling & Analysis	In-Service, Jar Test: Not in Service Every Hour: pH, Turbidity, R-Cl Daily: Turbidity, pH, Alkalinity, Hardness, Chlorine, Mn, Fe, D.O., R-Cl, Color, Oder, Bacteriorogical			
Clear Water Transmission Facility	Clear Water Sump	Volume=1,200 m^3×1 unit, Retention Time: 2.7 hr		Volume=1,000m^3×2 units, Volume=2,000m^3×1 unit Retention Time: 3.3 hr	
	Transmitted Pump & Motor	Horizontal Centrifugal Pump: ^{O}684m^3/hr × ^{H}136m × 400kw × 3 units (1 or 2 – Standby)	Design Cap. of Pump = 16 ～32MLD	Horizontal Centrifugal Pump: ^{O}684m^3/hr × ^{H}136m × 400kw × 4 units (1 – Standby)	Design Cap. of Pump = 49 MLD
	Transmission Line	D400mm × 800m × C.I.P. ×1 Line, D600mm × 800m × C.I.P. ×1 Line, D900mm × 800m × D.I.P. ×1 Line			
	Clear Water Reservoir (MBR)	Volume=800 m^3×4 units & Volume=5,000 m^3×1 unit, Total Volume = 7,400 m^3 in Assonora MBR			

Note: 1) ～ 4) are referring to "Manual on Water Supply and Treatment, Third Edition – Revised and Updated, May 1999"

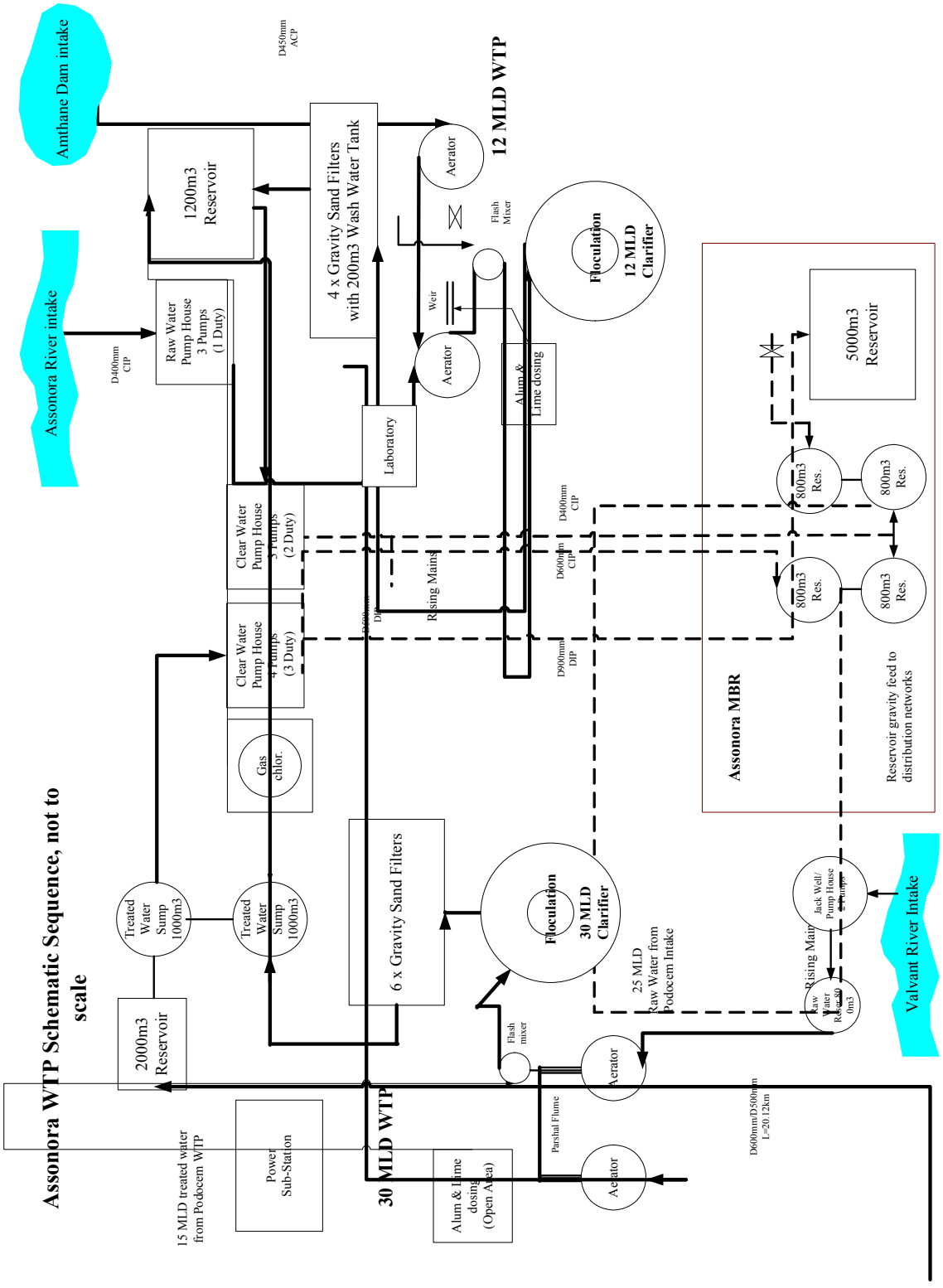

Figure M31.4.1 Schematic Sequence of Assonora Water Treatment Plant

Table M31.4.2 Present Conditions of Assonora Water Treatment Plant (1/9)

Item			Contents			Remarks
Background						
Covered Area for Water Supply		Taluka	Bardez & Part of Bicholim			
Name of Plant			Assonora W.T.P.			
Number of W.T.P.	Number		(1) 12 MLD	(2) 30 MLD	Total	
			Assonora w.T.P.	Assonora W.T.P.	from Podocem W.T.P.	
Capacity of Plant	MLD		12	30	15	57
	m^3/d		12,000	30,000	15,000	57,000
					15 MLD Clear Water Received from Padocem W.T.P.(40 MLD)	
Raw Water Resources	River		Assonora	Assonora		
				25 MLD Raw Water Received from Raw Water Reservoir via Valvant River Intake Pump Station		
	Dam		Anthane			
Year of Construction	Year					
Year of Commission	Year		1967	1992		
Expected Augmentation Plan (Tillari Irrigation Project)			40 MLD			

Table M31.4.2 Present Conditions of Assonora Water Treatment Plant (2/9)

Name & Number of W.T.P.		Number	(1) 12 MLD Assonora w.T.P.	(2) 30 MLD Assonora W.T.P.	(2) 30 MLD from Podocem W.T.P.	Total	Remarks
Capacity of Plant (Transmitted Water Supply from Plant)		MLD	12	30	15	57	
		m^3/d	12,000	30,000	15,000	57,000	
					15 MLD Clear Water Received from Padocem W.T.P.(40 MLD)		
Capacity of Raw Water Intake & Water Treatment Plant		MLD	12.6	31.5	15	59.1	: Estimated 5% lossesof Nominal Capacity
		m^3/d	12,600	31,500	15,000	59,100	

Name of Facility			Contents of Facility (1) 12 MLD	(2) 30 MLD			Total	Remarks
Head Water Works : Raw Water Intake								
Intake Well	Width	m	?	-	-	-	-	-	☐ One additional pump (9.0 m3/min×20 m) for 12 MLD Plant in case of insufficint raw water.
	Length	m	?	-	-	-	-	-	
	Height	m	?	-	-	-	-	-	
	Water Depth	m	?	-	-	-	-	-	
	Design Water Level		?	-	-	-	-	-	
	H.W.L.	m	?	-	-	-	-	-	
	L.W.L..	m	?	-	-	-	-	-	
	Volume	m^3/unit		-	-	-	-	-	
	Retention Time	min		-	-	-	-	-	
Connecting Pipe	Diameter	mm	400	-	-	-	-	-	D= 0.4
	Number of Line	No.	1	-	-	-	-	-	C= 110
	Length	m		-	-	-	-	-	Q= 0.146
	Material		CIP	-	-	-	-	-	
	Note		Assonora River	-	-	-	-	-	
				-	-	-	-	-	
	Velocity	m/sec	1.161	-	-	-	-	-	
	Loss of Head	m	0	-	-	-	-	-	
Raw Water Pump & Motor	Capacity	ℓ/sec	173.6	-	-	-	-	-	
		m^3/min	10.42	-	-	-	-	-	
		m^3/hr	625	-	-	-	-	-	
		m^3/d	15,000	-	-	-	-	-	
	Number	unit	3	-	-	-	-	-	
	Stand-by	unit	2	-	-	-	-	-	
	Total Capacity	m^3/d	15,000	-	-	-	-	-	
	Head	m	17.0	-	-	-	-	-	
	Maker		M & P	-	-	-	-	-	
	Year of Manufacture		1992	-	-	-	-	-	
	Assessment of Condition		Working	-	-	-	-	-	
	Motor Output	HP	74	-	-	-	-	-	
		kW	55	-	-	-	-	-	
	Number	Unit	3	-	-	-	-	-	
	Maker		Kirlosker	-	-	-	-	-	
	Year of Manufacture		1992	-	-	-	-	-	
	Assessment of Condition		Working	-	-	-	-	-	

Table M31.4.2 Present Conditions of Assonora Water Treatment Plant (3/9)

Name of Facility			Contents of Facility			Remarks
			(1) 12 MLD	(2) 30 MLD	Total	
Raw Water Transmission Line	Source of Raw Water		- from Amthane Tank to Aerator	25 MLD Raw Water Received from Raw Water Reservoir via Valvant River Intake Pump Station		
	Diameter	mm	- 450	600 600/500		
	Length	m	- 10,000	120 20,000		
	Material		- ACP	CIP / MS CIP		
	Velocity	m/sec	-	1.023		
	Loss of Head	m	-	43.561		
	Assessment of Condition	Pipe	- Good	Good		
		Valve	- Leakage	Leakage		
Water Treatment Plant						
Aerator	Capacity	m^3/hr/unit	262.5	656.3		
		m^3/d/unit	6,300	15,750		
	Number	Unit	2	2		
	Width	m	6.5	9.5		
	Length	m	3.4	1.5		
	El. of Top Aerator	m				
	Assessment of Condition		Working	Working		
Parshal Flume / Weir			Weir	2 × Parshal Flume		
	Assessment of Condition		Working	Working		
Flash Mixer			1 × Flash Mixer	1 × Flash Mixer		
	Assessment of Condition		Working	Working		
Clarifiers / Settling Tank (Coagulation Basin)	Dsign Capacity	m^3/min/unit	8.8	21.9		
		m^3/hr/unit	525.0	1,312.5		
		m^3/d/unit	12,600	31,500		
	Number	Unit	1	1		
	Water Depth	m	3.75	4.00		
	Overall Diameter	m	22.90 25.00	41.20		
	Flocc. Zone Dia.	m	10.20	18.40		
	Frequency of Desludging		Once a Day : General	Once a Day : General		
			Twice a Day : Monsoon Sea	Twice a Day : Monsoon Season		
	Volume					
	Overall	m^3/unit	1,544.5	5,332.7		
	Flocculation Zone	m^3/unit	306.42	1,063.62		
	Clarifying Zone	m^3/unit	1,238.09	4,269.05		
	Retention Time					
	Flocculation Zone	min	35.0	48.6		
	Clarifying Zone	min	141.5 OK	195.2 OK		
	Overall	min	176.5	243.8		
	Surface Area	m^2/unit	330.2	1,067.3		
	Surface Loading	mm/min	26.5 OK	20.5 OK		
	W.L. of Clarifier	m				
	Assessment of Condition		Working	Working		

D= 0.6
C= 110
Q= 0.289

Table M31.4.2 Present Conditions of Assonora Water Treatment Plant (4/9)

Name of Facility			Contents of Facility			Remarks
			(1) 12 MLD	(2) 30 MLD	Total	
Flocculator & Drive Arrangement	Number	unit	1	1		
	Assessment of Condition		Working	Working		
Filter	Design Capacity	m^3/hr/unit	131.25	218.8		
		m^3/d/unit	3,150	5,250.0		
	Number	Unit	4	6		
	Type		Rapid Gravity Sand Filter	Rapid Gravity Sand Filter		
	Width	m	6.00	8.60		
	Length	m	5.00	4.00		
	Height	m	3.00	3.00		
	Water Depth	m				
	Filtered Area	m^2/unit	30.0	34.4		
	Velocity	$m^3/d/m^2$	105.0	152.6		
	Filter Media					
	E.S. of Sand	mm	0.60 ~ 0.80	0.60 ~ 0.80 ?		
	Depth of Sand	mm	550 too thin	750		
	Type of Underdrain					
	Year Replacement of Media		2003 Replace New	2003 Replace New		
	Water Level of Filter	m				
	Assessment of Condition		Working	Working		
Filter Washing Criteria & Method	Air Scouring Rate	$m^3/min/m^2$	0.66 Generaly OK	0.56 NO		
	Air Scouring Time	min	10	10		
	Backwash Rate	$m^3/min/m^2$	0.44 Generaly OK	0.29 NO		
	Backwashing Time	min	15 Depend on turb. of wash water drain	15 Depend on turb. of wash water drain		
	Frequency of Washing		Once a Day : General Twice a Day : Maximum	Once a Day : General Twice a Day : Maximum		
Backwash Pump & Motor	Capacity	m^3/min	2.08 Lifting Pump to Back Wash Water Tank = $200m^3$	5.00		
		m^3/hr	125	300		
		m^3/d	3,000	7,200		
	Number	unit	2	2		
	Stand-by	unit	1	1		
	Total Capacity	m^3/min	2.08	5.00		
		m^3/d	3,000	7,200		
	Head	m				
	Type of Pump		Centrifugal Pump	Centrifugal Pump		
	Motor Output	HP	20	40		
		kW	14.9	29.8		
	Assessment of Condition		Working	Working		

Name of Facility				Contents of Facility (1) 12 MLD	Contents of Facility (2) 30 MLD	Total	Remarks
	Air Blower	Capacity	m^3/min	9.93	9.58		
			m^3/hr	596	575		
			m^3/d	14,304	13,800		
		Number	unit	2	2		
		Stand-by	unit	0	0		
		Total Capacity	m^3/min	19.87	19.17		
			m^3/d	28,608	27,600		
		Head	mm WG	5,000			
		Motor Output	HP	20	20		
			kW	15	15		
		Maker		USHA/Kirlosker	EVEREST/CROMPTON GREVES		
		Assessment of Condition		Working 2001	Working		
	Clear Water Reservoir	Number of C.W.R.	Unit	(1)	(1) (2)		
		Width	m	18.0	26.0		
		Diameter	m	-	21.0		
		Length	m	25.0	26.0		
		Water Depth	m	3.0	3.0 3.0		
		Number	Unit	1	2 1		
		Volume	m^3	1,350	1,039 2,028		
		Total	m^3	1,350 (1,200 m^3)	4,106 (4,000 m^3)		
		Detention Time	hr	2.7	3.3		
		Last Date of Cleaning		Pediodical	Pediodical Pediodical		
		Water Level	m				
		Assessment of Condition		Slab Damaged	Slab Damaged Under Construction		
Transmission (Clear Water) Facility							
	Transmission (Clear Water) Pump	Capacity	ℓ/sec	190.0	190.0		
			m^3/min	11.40	11.40		
			m^3/hr	684.0	684.0		
			m^3/d	16,416	16,416		
		Number	unit	3	4		
		Stand-by		2	1		
		Total Capacity	m^3/d	16,000	49,000		
		Head	m	136.0	136.0		
		Type of Pump		Centrifugal Pump	Centrifugal Pump		
		Maker		M & P	M & P		
		Year of Manufacture		1993	1993		
		Assessment of Condition	Pump	Working	Working		
			Valve	Working	Working		

Table M31.4.2 Present Conditions of Assonora Water Treatment Plant (6/9)

Name of Facility			Contents of Facility			Remarks
			(1) 12 MLD	(2) 30 MLD	Total	
Transmission (Clear Water) Motor	Motor Output	HP	536.4	536		
		kW	400	400		
	Number	Unit	3	4		
	Maker		GEC	GEC		
	Year of Manufacture		1993	1993		
	Assessment of Condition		Working	Working		
Raising Main (Transmission Lines)			Common for 2 Plants			
	Diameter	mm	400 600	900 3 Lines to 800 m^3 × 3 GLR & 5,000 m^3		
	Length	m	800 800	800 GLR at Assonora M.B.R.		
	Material		CIP "B" CIP "B"	DIP (K-9)		
	Velocity	m/sec				
	Assessment of	Pipe	Working			
	Condition	Valve	Working			
Chemical Facility						
Alum Feeding Facility	Capacity	kg/hr	-	-		
		m^3/unit				
	Diameter	m				
	Width	m				
	Length	m				
	Height	m				
	Volume	m^3				
	Number	Unit	2	2		
	Stand-by					
	Assessment of Condition		Functional	Non-Function : from Commissioning		
Lime Feeding Facility	Capacity	kg/hr	-	-		
		m^3/unit				
	Diameter	m				
	Width	m				
	Length	m				
	Height	m				
	Volume	m^3				
	Number	Unit		2		
	Stand-by					
	Assessment of Condition		Non-Function	Non-Function : from Commissioning		
Disinfection System			Common for 2 Plants			
	Chemical Used		Liquid Chlorine / Bleaching Powder			
	Type of Plant & Machinery		Chlorinators			
	Capacity	kg/hr	2.5			
	Number	Unit	4 : 2 for 12 MLD & 2 for 30 MLD			
	Stand-by		1			
	Safty Measures Taken		Neutralization (Caustic Soda)	: Tank Provided		
	Commissioned		1993			
	Assessment of Condition		Working			

Name of Facility			Contents of Facility (1) 12 MLD	(2) 30 MLD	Total	Remarks
Laboratory						
			Common for 2 Plants			
Chemical Testing Laboratory			In-service (Exist)			
Jar Testing			In-service (Exist)			
Availability of Skilled Chemists			Available			
Availability of Required Chemicals			Available			
			Average 2 Months Storage for Chemicals of Alum, Lime & Cl			
Use of Test Reports			As per Format			
Frequency of Sampling & Analysis			12 Parameters Tests Daily			
			Every Hour: pH, Turb. R.-Cl,			
			Daily : Other (Turb., pH, Alkalinity, Hardness, Chloride, Mn, Fe, D.O., R.-Cl,			
			Color, Odor, Bacteriological)Test			
			Bacteriological (once a day) : Raw Water -			
			: Clear water -			
General Quality of Water			Good			
	Raw Water Quality		Turbid.(Max:250NTU, Ave:35 - 40NTU, Min:10NTU),			
			Low pH (Max:6.97, Ave:6.80, Mun:6.50)			
	Clear Water Quality		Good			
Transformers						
			Common for 2 Plants			
Number of Transformer			(1) (2) (3) (4)			(2) Borrowed from Opa
Pole Mounted / Pad Mounted			Pad Pad Pad Pad			
Capacity		kVA	1,600 2,500 500 500			
Number		Unit	1 1 1 2			
Standby			1			
Commissioned			1993 1972 1993 1993			
Likely Design Life		Year				
Last Replacement						
Assessment of Condition			Working			
Equipment Status						
Flow Meters			Non-Functional	Not Provided		
Other Operating Valves			Need Replacement	Need Replacement		
Other Important Assets						
Valve's Condition			Working Condition			
Visible Leakage and Locations			Nil			
Building Condition						
Wastewater Disposal Arrangements			River Down Stream			

Table M31.4.2 Present Conditions of Assonora Water Treatment Plant (8/9)

Organization & Staff Deployed				
General Shift		2 Plants (12 MLD & 30 MLD)		
	Working Hour :	08:30 → 17:30 (12:30 → 13.30 : Lunch Time)		
	Staff Deployed :	Management Staff - Engineers		
		Assistant Engineer	1 Person	
		Junior Engineer	3 Persons	
		L.D.C	1 Person	
		Peon	1 Person	
		Watchman	2 Persons	
		Drivers	4 Persons	
		Others	19 Persons	
		Total	31 Persons	
Shift in Plant Operation	Shifting System	3 Shifting System Covering 24 Hours		
	Working Hour :	①: 08:00 → 14:00 , ②: 14:00 → 21:00 , ③: 21:00 → 08:00		
	Grouping Staff Deployed :	2 Plants (12 MLD & 30		
		Shift in Charge		
		Electrician, Operator, Security, etc.		Total 13 ～ 14 Persons

Table M31.4.2 Present Conditions of Assonora Water Treatment Plant (9/9)

Staff Deployed at the Plant	2 Plants (12 MLD & 30 MLD)			
	Person	Qualification	Year of Service	Service at plant
Management Staff - Engineers				
Assistant Engineer	1			
Junior Engineer	3			
Assistant Chemist	1			
Lab. Technician	1			
L.D.C	1			
Peon	1			
Watchman	1			
Drivers	4			
Sub-total	13			
Skilled Staff - Operators / Quality Testing				
Work Assistant	2			
Electrician	3			
Pump Operator	1			
Plumber	2			
Assist. Plumber	1			
Assistant Operator	2			
Lab - Technician	1			
Mechanic G - II	3			
Lab - Attendant	2			
Filter Operator	1			
Chlorine Operator	1			
Highly Skilled Labour	2			
Skilled Worker	8			
Assist. Mason	1			
Senior Operator	1			
Sub-total	31			
Unskilled Staff	43	- Junior Operator, Watchman, Sweeper, Khalashi, Labour, Unskilled Worker, Helper, Workman		
Total Number	87			

Table M31.4.3 Monthly Water Quality of Assonora Water Treatment Plant, 12MLD Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

	Color			Odor			Taste			Turbidity (NTU)			pH			Specific Conductivity (/u mhos/cm)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0	0		Unobjectable			Unobjectable			2.3	1.5		6.9	7.1		41.1	49.4	
Feb-03	0	0		Unobjectable			Unobjectable			0.8	0.3		6.7	7.1		44.3	53.8	
Mar-03	0	0		Unobjectable			Unobjectable			3.2	1.2		6.3	7.3		51.0	72.4	
Apr-03	0	0		Unobjectable			Unobjectable			3.0	1.5		6.7	6.8		58.4	59.8	
May-03	0	0		Unobjectable			Unobjectable			3.2	2.0		6.8	6.8		56.6	58.9	
Jun-03	0	0		Unobjectable			Unobjectable			13.6	2.5		6.1	7.6		46.5	73.7	
Jul-03	0	0		Unobjectable			Unobjectable			3.8	1.5		6.7	7.2		43.3	62.7	
Aug-03	0	0		Unobjectable			Unobjectable			2.8	1.0		6.4	6.8		38.8	47.7	
Sep-03	0	0		Unobjectable			Unobjectable			3.3	0.9		6.9	7.1		47.4	56.0	
Oct-03	0	0		Unobjectable			Unobjectable			1.0	0.6		6.9	7.2		39.9	53.2	
Nov-03	0	0		Unobjectable			Unobjectable			1.3	0.8		6.8	7.0		42.4	53.8	
Dec-03	0	0		Unobjectable			Unobjectable			0.9	0.5		7.0	7.9		47.3	63.0	
Jan-04	0	0		Unobjectable			Unobjectable			1.4	0.5		7.0	8.8		46.7	60.8	
Feb-04	0	0		Unobjectable			Unobjectable			1.4	0.3		7.3	7.5		41.2	47.6	
Mar-04	0	0	0	Unobjectable			Unobjectable			2.0	0.7	0.7	6.8	7.2	7.0	47.1	56.0	56.7
Apr-04	0	0	0	Unobjectable			Unobjectable			2.9	0.5	0.5	6.8	7.9	7.5	48.6	70.3	71.4
May-04	0	0	0	Unobjectable			Unobjectable			6.3	1.6	1.5	7.3	7.1	7.1	102.4	101.4	109.5
Jun-04	0	0	0	Unobjectable			Unobjectable			2.6	1.3	1.0	6.8	7.0	7.1	53.1	56.3	56.0
Jul-04	0	0	0	Unobjectable			Unobjectable			6.2	1.4	1.0	6.7	7.9	7.7	55.2	64.7	64.9
Aug-04	0	0	0	Unobjectable			Unobjectable			4.8	1.5	1.4	7.0	7.2	7.2	48.1	52.1	53.5
Sep-04	0	0	0	Unobjectable			Unobjectable			4.8	2.0	1.4	6.9	7.3	7.2	50.8	51.2	52.2
Oct-04	0	0	0	Unobjectable			Unobjectable			1.0	0.5	0.4	7.1	7.3	7.2	48.8	40.0	40.4
Nov-04	0	0	0	Unobjectable			Unobjectable			1.0	0.8	0.9	6.7	6.8	6.8	44.3	50.8	53.6
Dec-04	0	0	0	Unobjectable			Unobjectable			2.0	1.2	1.5	7.2	7.5	8.1	44.6	56.0	56.9
Jan-05	0	0	0	Unobjectable			Unobjectable			1.8	1.0	1.0	7.2	7.5	7.5	45.8	54.6	56.5
Feb-05	0	0	0	Unobjectable			Unobjectable			2.0	1.7	1.7	6.9	7.1	7.1	44.5	56.3	57.0
Mar-05	0	0	0	Unobjectable			Unobjectable			2.5	1.3	1.3	6.7	7.1	7.0	45.9	58.6	58.5
Apr-05	0	0	0	Unobjectable			Unobjectable			3.0	1.5	1.3	6.5	7.1	7.1	53.2	65.5	65.7
May-05	0	0	0	Unobjectable			Unobjectable			3.4	1.9	2.0	7.1	7.2	7.2	50.3	59.8	62.2
Max	0	0	0							13.6	2.5	2	7.3	8.8	8.1	102.4	101.4	109.5
Min	0	0	0	Unobjectable			Unobjectable			0.8	0.3	0.4	6.1	6.8	6.8	38.8	40.0	40.4
Average	0.0	0.0	0.0							3.0	1.2	0.6	6.8	7.3	3.8	49.2	58.8	31.6

	Total Solids (mg/L)			Total Dissolved Solids (TDS) (mg/L)			Suspended Solids (mg/L)			Total Hardness as $CaCO_3$ (TALK) (mg/L)			Ca^{2+} (mg/L)			Mg^{2+} (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	26.0	31.0		26.0	31.0		0.0	0.0		12.0	14.0		3.6	4.4		0.8	0.3	
Feb-03	29.0	35.0		29.0	35.0		0.0	0.0		13.0	16.0		3.6	1.8		1.0	1.0	
Mar-03	33.0	45.0		32.0	46.0		1.5	0.0		17.0	28.0		3.6	8.4		2.0	2.0	
Apr-03	38.0	39.0		37.0	39.0		1.0	0.0		23.0	24.0		4.0	4.4		3.3	3.3	
May-03	38.0	37.0		36.0	37.0		2.0	0.0		25.0	25.0		4.8	4.8		3.3	3.3	
Jun-03	34.0	47.0		30.0	47.0		4.0	0.0		19.0	37.0		3.6	9.6		2.5	3.3	
Jul-03	29.5	40.0		28.0	40.0		1.5	0.0		15.0	23.0		3.6	6.0		1.5	2.0	
Aug-03	26.0	31.0		25.0	31.0		1.0	0.0		16.0	20.0		3.2	4.8		2.0	2.0	
Sep-03	31.5	36.0		30.0	36.0		1.5	0.0		16.0	23.0		3.2	6.0		2	2.0	
Oct-03	26.0	34.5		26.0	34.5		0.0	0.0		16.0	20.0		3.2	5.6		2.0	1.0	
Nov-03	27.0	34.0		27.0	34.0		0.0	0.0		16.0	22.0		3.6	5.6		1.8	2.0	
Dec-03	30.0	39.0		30.0	39.0		0.0	0.0		17.0	26.0		3.6	6.4		2.0	2.5	
Jan-04	30.0	39.0		30.0	39.0		0.0	0.0		16.0	25.0		3.6	6.4		1.8	2.3	
Feb-04	26.0	30.0		26.0	30.0		0.0	0.0		14.0	19.0		3.6	5.2		1.3	1.5	
Mar-04	29.5	36.0	36.0	30.0	36.0	36.0	0.5	0.0	0.0	15.0	20.0	20.0	3.6	5.6	5.6	1.5	1.5	1.5
Apr-04	31.5	45.0	45.5	31.0	45.0	45.5	0.5	0.0	0.0	15.0	25.0	25.0	3.2	7.2	7.2	1.8	1.8	1.8
May-04	67.0	65.0	70.0	65.0	65.0	70.0	2.0	0.0	0.0	40.0	40.0	40.0	10.0	10.0	10.0	3.8	3.8	3.8
Jun-04	34.0	36.0	36.0	33.5	36.0	36.0	0.5	0.0	0.0	14.0	16.0	16.0	3.2	4.0	4.0	1.5	1.5	1.5
Jul-04	37.5	41.5	41.5	35.5	41.5	41.5	2.0	0.0	0.0	18.0	26.0	26.0	4.4	7.2	7.2	1.8	2.0	2.0
Aug-04	32.0	33.0	34.0	31.0	33.0	34.0	1.0	0.0	0.0	17.0	20.0	20.0	4.0	4.8	4.8	1.8	2.0	2.0
Sep-04	33.0	33.0	33.5	32.0	33.0	33.5	1.0	0.0	0.0	15.0	19.0	19.0	4.0	4.8	4.8	1.3	1.8	1.8
Oct-04	31.0	31.5	31.5	31.0	31.5	31.5	0.0	0.0	0.0	17.0	17.0	17.0	4.8	4.8	4.8	1.3	1.3	1.3
Nov-04	28.0	32.5	34.0	28.0	32.5	34.0	0.0	0.0	0.0	14.0	18.0	18.0	3.6	4.8	4.8	1.3	1.5	1.5
Dec-04	29.5	36.0	36.5	28.5	36.0	36.5	0.0	0.0	0.0	15.0	20.0	21.0	3.6	5.6	6.0	1.5	1.5	1.5
Jan-05	29.5	35.0	36.0	29.0	35.0	36.0	0.5	0.0	0.0	14.0	17.0	17.0	3.6	4.8	4.8	1.2	1.3	1.3
Feb-05	28.0	36.0	36.0	28.0	36.0	36.0	0.0	0.0	0.0	13.0	17.0	17.0	3.2	4.8	4.8	1.3	1.3	1.3
Mar-05	29.0	37.5	37.5	29.0	37.5	37.5	0.0	0.0	0.0	14.0	18.0	18.0	3.2	4.8	4.8	1.5	1.5	1.5
Apr-05	35.0	42.0	42.0	34.0	42.0	42.0	1.0	0.0	0.0	19.0	25.0	25.0	5.2	7.2	7.2	1.5	1.8	1.8
May-05	33.0	38.0	40.0	32.0	38.0	40.0	1.0	0.0	0.0	17.0	20.0	20.0	4.0	5.2	5.2	1.8	1.8	1.8
Max	67.0	65.0	70.0	65.0	65.0	70.0	4.0	0.0	0.0	40.0	40.0	40.0	10.0	10.0	10.0	3.8	3.8	3.8
Min	26.0	30.0	31.5	25.0	30.0	31.5	0.0	0.0	0.0	12.0	14.0	16.0	3.2	1.8	4.0	0.8	0.3	1.3
Average	32.1	37.8	20.3	31.4	37.8	20.3	0.8	0.0	0.0	17.0	22.1	11.0	3.9	5.7	3.0	1.8	1.9	0.9

Table M31.4.3 Monthly Water Quality of Assonora Water Treatment Plant, 12MLD Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

	Cl^- (mg/L)			Total Alkalinity as $CaCO_3$ (mg/L)			SO_4^- (mg/L)			Fe^{2+} (mg/L)			Mn^{2+} (mg/L)			NO_3^{2-} (mg/L)			$KMnO_4$ oxidizability as O_2 (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	6.0	6.0		12.0	13.0		0.0	0.0		0.05	0.05		0.00	0.00		0.6	0.0		0.2	0.0	
Feb-03	6.0	6.0		13.0	16.0		0.0	0.0		0.05	0.05		0.24	0.00		0.4	0.0		0.2	0.0	
Mar-03	6.0	6.0		16.0	29.0		0.0	0.0		0.06	0.05		0.00	0.00		1.3	0.0		0.2	0.0	
Apr-03	6.0	6.0		21.0	23.0		0.0	0.0		0.30	0.05		0.00	0.00		0.7	0.0		0.2	0.0	
May-03	6.0	6.0		23.0	23.0		0.0	0.0		0.06	0.05		0.00	0.00		0.4	0.0		0.2	0.0	
Jun-03	4.0	4.0		20.0	32.0		0.0	0.0		0.45	0.06		0.00	0.00		0.8	0.0		0.4	0.0	
Jul-03	6.0	6.0		16.0	20.0		0.0	0.0		0.10	0.05		0.00	0.00		0.9	0.0		0.3	0.0	
Aug-03	6.0	6.0		17.0	17.0		0.0	0.0		0.20	0.05		0.00	0.00		0.4	0.0		0.3	0.0	
Sep-03	6	6.0		17	20.0		0.0	0.0		0.05	0.05		0.00	0.00		0.8	0.0		0.2	0.0	
Oct-03	6.0	6.0		23.0	25.0		0.0	0.0		0.10	0.05		0.00	0.00		0.9	0.0		0.2	0.0	
Nov-03	6.0	6.0		20.0	23.0		0.0	0.0		0.05	0.05		0.10	0.00		0.4	0.0		0.2	0.0	
Dec-03	6.0	6.0		18.0	24.0		0.0	0.0		0.06	0.05		0.08	0.00		0.8	0.0		0.4	0.0	
Jan-04	6.0	6.0		18.0	26.0		0.0	0.0		0.10	0.05		0.00	0.00		1.9	0.0		0.4	0.0	
Feb-04	6.0	6.0		18.0	22.0		0.0	0.0		0.05	0.05		0.00	0.00		1.5	0.0		0.3	0.0	
Mar-04	6.0	6.0	6.0	20.0	23.0	23.0	0.0	0.0	0.0	0.12	0.05	0.05	0.00	0.00	0.00	1.2	0.0	0.0	0.3	0.0	0.0
Apr-04	6.0	6.0	6.0	21.0	35.0	32.0	0.0	0.0	0.0	0.08	0.05	0.05	0.00	0.00	0.00	1.0	0.0	0.0	0.3	0.0	0.0
May-04	7.0	7.0	9.0	44.0	44.4	44.0	0.0	0.0	0.0	0.60	0.10	0.10	0.00	0.00	0.00	1.4	0.0	0.0	0.6	0.0	0.0
Jun-04	7.0	7.0	7.0	15.0	18.0	18.0	0.0	0.0	0.0	0.06	0.05	0.05	0.00	0.00	0.00	0.6	0.0	0.0	0.2	0.0	0.0
Jul-04	7.0	7.0	7.0	17.0	28.0	28.0	0.0	0.0	0.0	0.30	0.05	0.05	0.12	0.00	0.00	0.8	0.0	0.0	0.4	0.0	0.0
Aug-04	6.0	6.0	7.0	17.0	18.0	18.0	0.0	0.0	0.0	0.20	0.10	0.10	0.00	0.00	0.00	0.5	0.0	0.0	0.3	0.0	0.0
Sep-04	6.0	6.0	7.0	16.0	21.0	21.0	0.0	0.0	0.0	0.06	0.06	0.06	0.00	0.00	0.00	0.4	0.0	0.0	0.2	0.0	0.0
Oct-04	6.0	6.0	6.0	18.0	19.0	19.0	0.0	0.0	0.0	0.06	0.05	0.05	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Nov-04	6.0	6.0	7.0	16.0	19.0	19.0	0.0	0.0	0.0	0.06	0.05	0.05	0.10	0.00	0.00	0.2	0.0	0.0	0.0	0.0	0.0
Dec-04	6.0	6.0	6.0	19.0	24.0	25.0	0.0	0.0	0.0	0.06	0.05	0.05	0.00	0.00	0.00	0.0	0.0	0.0	0.2	0.0	0.0
Jan-05	6.0	7.0	8.0	18.0	19.0	19.0	0.0	0.0	0.0	0.40	0.06	0.06	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Feb-05	6.0	6.0	6.0	17.0	21.0	21.0	0.0	0.0	0.0	0.06	0.05	0.05	0.00	0.00	0.00	0.6	0.0	0.0	0.3	0.0	0.0
Mar-05	7.0	7.0	7.0	16.0	20.0	20.0	0.0	0.0	0.0	0.10	0.06	0.06	0.00	0.00	0.00	0.4	0.0	0.0	0.2	0.0	0.0
Apr-05	7.0	7.0	8.0	17.0	25.0	25.0	0.0	0.0	0.0	0.10	0.06	0.06	0.12	0.00	0.00	0.5	0.0	0.0	0.3	0.0	0.0
May-05	6.0	8.0	10.0	17.0	18.0	18.0	0.0	0.0	0.0	0.20	0.10	0.10	0.00	0.00	0.00	0.8	0.0	0.0	0.3	0.0	0.0
Max	7.0	8.0	10.0	44.0	44.4	44.0	0.0	0.0	0.0	0.60	0.10	0.10	0.24	0.00	0.00	1.9	0.0	0.0	0.6	0.0	0.0
Min	4.0	4.0	6.0	12.0	13.0	18.0	0.0	0.0	0.0	0.05	0.05	0.05	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Average	6.1	6.2	3.7	18.6	22.9	12.1	0.0	0.0	0.0	0.14	0.06	0.03	0.03	0.00	0.00	0.7	0.0	0.0	0.3	0.0	0.0

	BOD at 27°C and 3days (mg/L)			DO (mg/L)			F^- (mg/L)			Al^{3+} (mg/L)			Plate Count on nutrient agar no/100mL			MPN of Coliform no/100mL			MPN of E.Coli. no/100mL		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0.5	0.0					0.0	0.0		0.0	0.00		0	0		0	0	0	0	0	0
Feb-03	0.5	0.0					0.0	0.0		0.0	0.00		0	0		0	0	0	0	0	0
Mar-03	0.5	0.0					0.0	0.0		0.0	0.00		86	2		1100	0	0	150	0	0
Apr-03	0.5	0.0					0.0	0.0		0.0	0.00		0	0		0	0	0	0	0	0
May-03	0.5	0.0					0.0	0.0		0.0	0.00		0	0		0	0	0	0	0	0
Jun-03	1.0	0.0					0.0	0.0		0.0	0.33		0	0		0	0	0	0	0	0
Jul-03	1.0	0.0					0.0	0.0		0.0	0.21		0	0		0	0	0	0	0	0
Aug-03	0.5	0.0					0.0	0.0		0.0	0.04		127	3		150	0	0	93	0	0
Sep-03	0.5	0.0					0.0	0.0		0.0	0.02		140	1		93	0	0	43	0	0
Oct-03	0.5	0.0		7.1	7.2		0.0	0.0		0.0	0.04		137	0		460	0	0	240	0	0
Nov-03	0.5	0.0		7.1	7.2		0.0	0.0		0.0	0.04		70	28	1	430	0	0	230	0	0
Dec-03	1.9	0.0		7.2			0.0	0.0		0.0	0.05		82	13	0	460	23	0	460	0	0
Jan-04	1.2	0.0		7.3	7.4		0.0	0.0		0.0	0.00		82	13	0	460	23	0	460	0	0
Feb-04	0.8	0.0		7.3	7.4		0.0	0.0		0.0	0.00		88	40	0	460	460	0	460	240	0
Mar-04	0.8	0.0	0.0	7.2	7.3	7.3	0.0	0.0	0.0	0.0	0.00	0.00	104	4	2	43	0	0	23	0	0
Apr-04	0.6	0.0	0.0	7.2	7.4	7.5	0.0	0.0	0.0	0.0	0.00	0.00	135	75	2	240	93	0	9	7	0
May-04	1.2	0.0	0.0	6.9	7.0	7.2	0.0	0.0	0.0	0.0	0.00	0.00	107	67	2	1100	460	0	460	93	0
Jun-04	0.6	0.0	0.0	6.9	7.5	7.5	0.0	0.0	0.0	0.0	0.00	0.00	87	12	1	240	4	0	240	0	0
Jul-04	1.1	0.0	0.0	7.1	7.2	7.2	0.0	0.0	0.0	0.0	0.10	0.1	220	140	3	93	93	0	43	21	0
Aug-04	0.5	0.0	0.0	7.0	7.3	7.4	0.0	0.0	0.0	0.0	0.05	0.05	123	12	0	240	43	0	93	0	0
Sep-04	0.5	0.0	0.0	7.0	7.4	7.4	0.0	0.0	0.0	0.0	0.05	0.05	192	15	0	240	21	0	21	0	0
Oct-04	0.0	0.0	0.0	7.2	7.4	7.4	0.0	0.0	0.0	0.0	0.04	0.04	180	4	0	460	9	0	240	0	0
Nov-04	0.0	0.0	0.0	7.1	7.3	7.4	0.0	0.0	0.0	0.0	0.01	0.01	140	25	2	460	39	0	21	7	0
Dec-04	0.5	0.0	0.0	7.5	7.6	7.6	0.0	0.0	0.0	0.0	0.01	0.01	71	12	2	1100	23	0	240	4	0
Jan-05	0.0	0.0	0.0	7.5	7.6	7.6	0.0	0.0	0.0	0.0	0.01	0.01	88	5	3	93	0	0	28	0	0
Feb-05	0.5	0.0	0.0	7.3	7.5	7.5	0.0	0.0	0.0	0.0	0.00	0.00	45	35	2	93	4	0	0	0	0
Mar-05	0.5	0.0	0.0	7.5	7.8	7.8	0.0	0.0	0.0	0.0	0.00	0.00	112	12	0	93	15	0	23	0	0
Apr-05	0.5	0.0	0.0	7.4	7.6	7.6	0.0	0.0	0.0	0.0	0.00	0.00	178	15	2	460	4	0	240	0	0
May-05	0.6	0.0	0.0	7.0	7.2	7.2	0.0	0.0	0.0	0.0	0.02	0.02	120	35	0	1100	3	0	23	0	0
Max	1.9	0.0	0.0	7.5	7.8	7.8	0.0	0.0	0.0	0.0	0.3	0.1	220	140	3	1100	460	0	460	240	0
Min	0.0	0.0	0.0	6.9	7.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0
Average	0.6	0.0	0.0	5.0	4.8	3.8	0.0	0.0	0.0	0.0	0.0	0.0	93.6	19.6	0.8	333.4	45.4	0.0	132.4	12.8	0.0

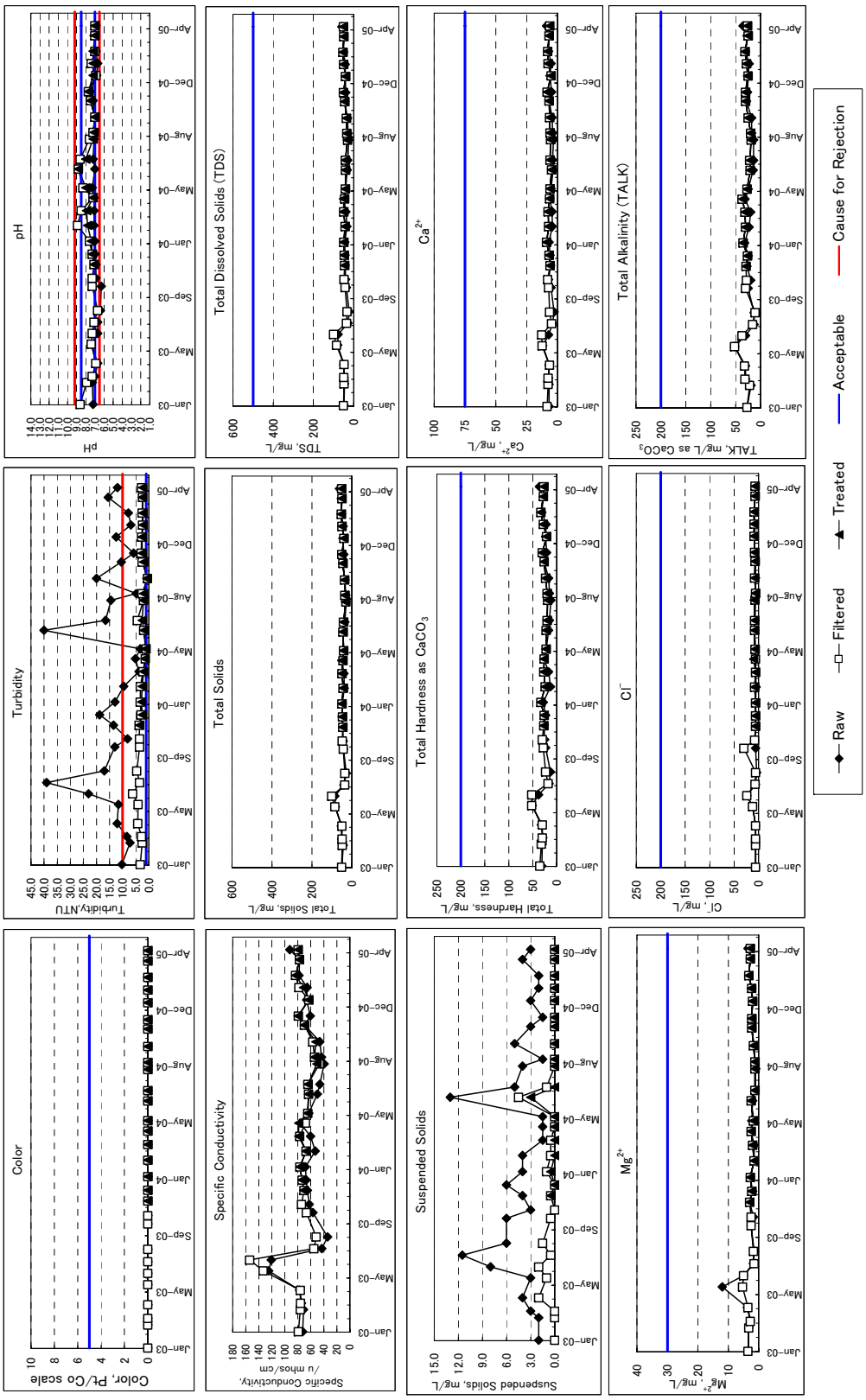

Figure M31.4.2 Monthly Water Quality of Assonora Water Treatment Plant, 12MLD Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

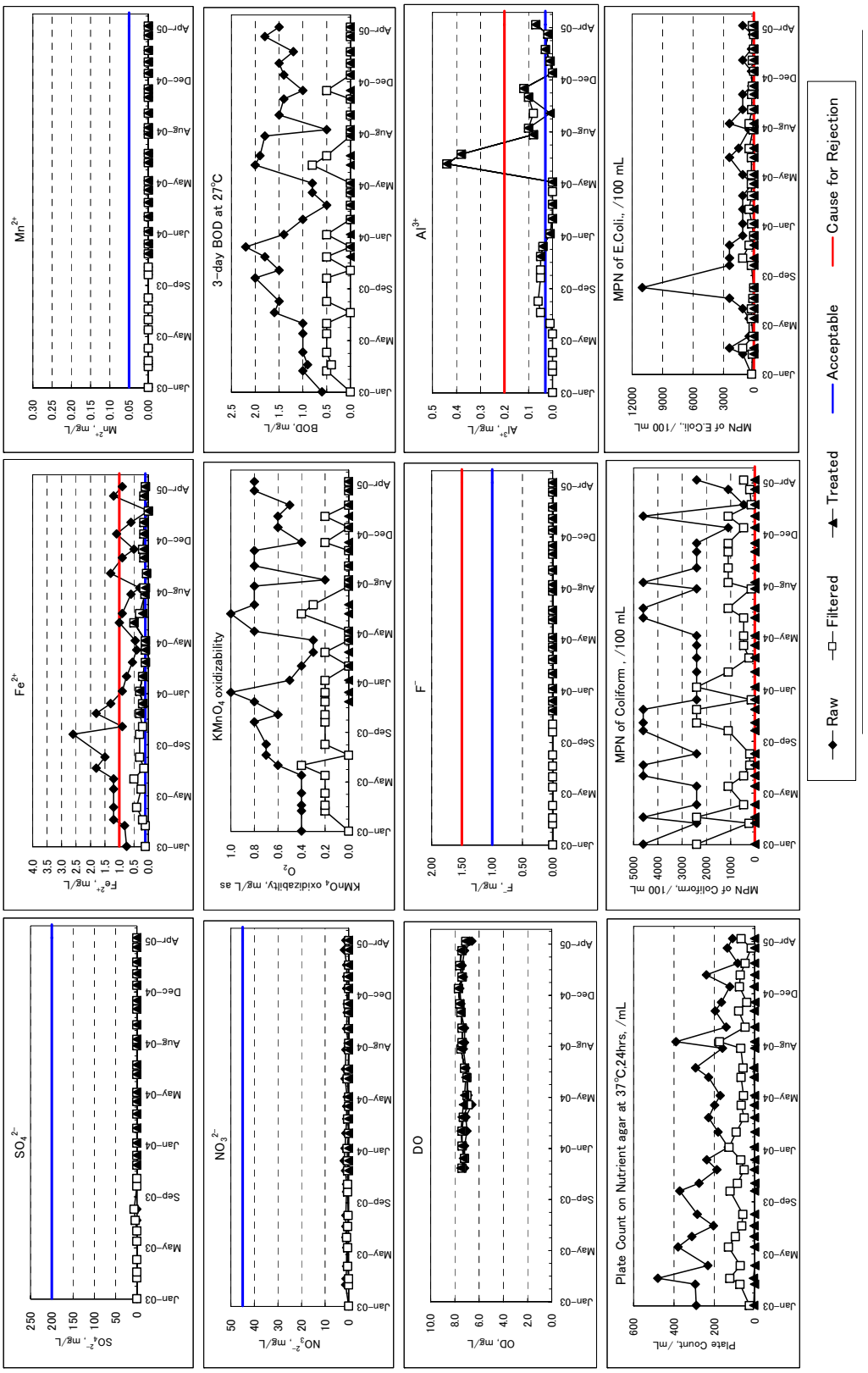

Figure M31.4.2 Monthly Water Quality of Assonora Water Treatment Plant, 12MLD Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

Table M31.4.4 Monthly Water Quality of Assonora Water Treatment Plant, 30MLD Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

	Color			Odor			Taste			Turbidity (NTU)			pH			Specific Conductivity (/u mhos/cm)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0	0		Unobjectable			Unobjectable			2.3	1.5		6.9	7.1		41.1	49.4	
Feb-03	0	0		Unobjectable			Unobjectable			0.8	0.3		6.7	7.1		44.3	53.8	
Mar-03	0	0		Unobjectable			Unobjectable			3.2	1.2		6.3	7.3		51.0	72.4	
Apr-03	0	0		Unobjectable			Unobjectable			3.0	1.5		6.7	6.8		58.4	59.8	
May-03	0	0		Unobjectable			Unobjectable			3.2	2.0		6.8	6.8		56.6	58.9	
Jun-03	0	0		Unobjectable			Unobjectable			13.6	2.5		6.1	7.6		46.5	73.7	
Jul-03	0	0		Unobjectable			Unobjectable			3.8	1.5		6.7	7.2		43.3	62.7	
Aug-03	0	0		Unobjectable			Unobjectable			2.8	1.0		6.4	6.8		38.8	47.7	
Sep-03	0	0		Unobjectable			Unobjectable			3.3	0.9		6.9	7.1		47.4	56.0	
Oct-03	0	0		Unobjectable			Unobjectable			1.0	0.6		6.9	7.2		39.9	53.2	
Nov-03	0	0		Unobjectable			Unobjectable			1.3	0.8		6.8	7.0		42.4	53.8	
Dec-03	0	0		Unobjectable			Unobjectable			0.9	0.5		7.0	7.9		47.3	63.0	
Jan-04	0	0		Unobjectable			Unobjectable			1.4	0.5		7.0	8.8		46.7	60.8	
Feb-04	0	0		Unobjectable			Unobjectable			1.4	0.3		7.3	7.5		41.2	47.6	
Mar-04	0	0	0	Unobjectable			Unobjectable			2.0	0.7	0.7	6.8	7.2	7.0	47.1	56.0	56.7
Apr-04	0	0	0	Unobjectable			Unobjectable			2.9	0.5	0.5	6.8	7.9	7.5	48.6	70.3	71.4
May-04	0	0	0	Unobjectable			Unobjectable			6.3	1.6	1.5	7.3	7.1	7.1	102.4	101.4	109.5
Jun-04	0	0	0	Unobjectable			Unobjectable			2.6	1.3	1.0	6.8	7.0	7.1	53.1	56.3	56.0
Jul-04	0	0	0	Unobjectable			Unobjectable			6.2	1.4	1.0	6.7	7.9	7.7	55.2	64.7	64.9
Aug-04	0	0	0	Unobjectable			Unobjectable			4.8	1.5	1.4	7.0	7.2	7.2	48.1	52.1	53.5
Sep-04	0	0	0	Unobjectable			Unobjectable			4.8	2.0	1.4	6.9	7.3	7.2	50.8	51.2	52.2
Oct-04	0	0	0	Unobjectable			Unobjectable			1.0	0.5	0.4	7.1	7.3	7.2	48.8	40.0	40.4
Nov-04	0	0	0	Unobjectable			Unobjectable			1.0	0.8	0.9	6.7	6.8	6.8	44.3	50.8	53.6
Dec-04	0	0	0	Unobjectable			Unobjectable			2.0	1.2	1.5	7.2	7.5	8.1	44.6	56.0	56.9
Jan-05	0	0	0	Unobjectable			Unobjectable			1.8	1.0	1.0	7.2	7.5	7.5	45.8	54.6	56.5
Feb-05	0	0	0	Unobjectable			Unobjectable			2.0	1.7	1.7	6.9	7.1	7.1	44.5	56.3	57.0
Mar-05	0	0	0	Unobjectable			Unobjectable			2.5	1.3	1.3	6.7	7.1	7.0	45.9	58.6	58.5
Apr-05	0	0	0	Unobjectable			Unobjectable			3.0	1.5	1.3	6.5	7.1	7.1	53.2	65.5	65.7
May-05	0	0	0	Unobjectable			Unobjectable			3.4	1.9	2.0	7.1	7.2	7.2	50.3	59.8	62.2
Max	0	0	0							13.6	2.5	2	7.3	8.8	8.1	102.4	101.4	109.5
Min	0	0	0	Unobjectable			Unobjectable			0.8	0.3	0.4	6.1	6.8	6.8	38.8	40.0	40.4
Average	0.0	0.0	0.0							3.0	1.2	0.6	6.8	7.3	3.8	49.2	58.8	31.6

	Total Solids (mg/L)			Total Dissolved Solids (TDS) (mg/L)			Suspended Solids (mg/L)			Total Hardness as $CaCO_3$ (TALK) (mg/L)			Ca^{2+} (mg/L)			Mg^{2+} (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	26.0	31.0		26.0	31.0		0.0	0.0		12.0	14.0		3.6	4.4		0.8	0.3	
Feb-03	29.0	35.0		29.0	35.0		0.0	0.0		13.0	16.0		3.6	1.8		1.0	1.0	
Mar-03	33.0	45.0		32.0	46.0		1.5	0.0		17.0	28.0		3.6	8.4		2.0	2.0	
Apr-03	38.0	39.0		37.0	39.0		1.0	0.0		23.0	24.0		4.0	4.4		3.3	3.3	
May-03	38.0	37.0		36.0	37.0		2.0	0.0		25.0	25.0		4.8	4.8		3.3	3.3	
Jun-03	34.0	47.0		30.0	47.0		4.0	0.0		19.0	37.0		3.6	9.6		2.5	3.3	
Jul-03	29.5	40.0		28.0	40.0		1.5	0.0		15.0	23.0		3.6	6.0		1.5	2.0	
Aug-03	26.0	31.0		25.0	31.0		1.0	0.0		16.0	20.0		3.2	4.8		2.0	2.0	
Sep-03	31.5	36.0		30.0	36.0		1.5	0.0		16.0	23.0		3.2	6.0		2	2.0	
Oct-03	26.0	34.5		26.0	34.5		0.0	0.0		16.0	20.0		3.2	5.6		2.0	1.0	
Nov-03	27.0	34.0		27.0	34.0		0.0	0.0		16.0	22.0		3.6	5.6		1.8	2.0	
Dec-03	30.0	39.0		30.0	39.0		0.0	0.0		17.0	26.0		3.6	6.4		2.0	2.5	
Jan-04	30.0	39.0		30.0	39.0		0.0	0.0		16.0	25.0		3.6	6.4		1.8	2.3	
Feb-04	26.0	30.0		26.0	30.0		0.0	0.0		14.0	19.0		3.6	5.2		1.3	1.5	
Mar-04	29.5	36.0	36.0	30.0	36.0	36.0	0.5	0.0	0.0	15.0	20.0	20.0	3.6	5.6	5.6	1.5	1.5	1.5
Apr-04	31.5	45.0	45.5	31.0	45.0	45.5	0.5	0.0	0.0	15.0	25.0	25.0	3.2	7.2	7.2	1.8	1.8	1.8
May-04	67.0	65.0	70.0	65.0	65.0	70.0	2.0	0.0	0.0	40.0	40.0	40.0	10.0	10.0	10.0	3.8	3.8	3.8
Jun-04	34.0	36.0	36.0	33.5	36.0	36.0	0.5	0.0	0.0	14.0	16.0	16.0	3.2	4.0	4.0	1.5	1.5	1.5
Jul-04	37.5	41.5	41.5	35.5	41.5	41.5	2.0	0.0	0.0	18.0	26.0	26.0	4.4	7.2	7.2	1.8	2.0	2.0
Aug-04	32.0	33.0	34.0	31.0	33.0	34.0	1.0	0.0	0.0	17.0	20.0	20.0	4.0	4.8	4.8	1.8	2.0	2.0
Sep-04	33.0	33.0	33.5	32.0	33.0	33.5	1.0	0.0	0.0	15.0	19.0	19.0	4.0	4.8	4.8	1.3	1.8	1.8
Oct-04	31.0	31.5	31.5	31.0	31.5	31.5	0.0	0.0	0.0	17.0	17.0	17.0	4.8	4.8	4.8	1.3	1.3	1.3
Nov-04	28.0	32.5	34.0	28.0	32.5	34.0	0.0	0.0	0.0	14.0	18.0	18.0	3.6	4.8	4.8	1.3	1.5	1.5
Dec-04	29.5	36.0	36.5	28.5	36.0	36.5	0.0	0.0	0.0	15.0	20.0	21.0	3.6	5.6	6.0	1.5	1.5	1.5
Jan-05	29.5	35.0	36.0	29.0	35.0	36.0	0.5	0.0	0.0	14.0	17.0	17.0	3.6	4.8	4.8	1.2	1.3	1.3
Feb-05	28.0	36.0	36.0	28.0	36.0	36.0	0.0	0.0	0.0	13.0	17.0	17.0	3.2	4.8	4.8	1.3	1.3	1.3
Mar-05	29.0	37.5	37.5	29.0	37.5	37.5	0.0	0.0	0.0	14.0	18.0	18.0	3.2	4.8	4.8	1.5	1.5	1.5
Apr-05	35.0	42.0	42.0	34.0	42.0	42.0	1.0	0.0	0.0	19.0	25.0	25.0	5.2	7.2	7.2	1.5	1.8	1.8
May-05	33.0	38.0	40.0	32.0	38.0	40.0	1.0	0.0	0.0	17.0	20.0	20.0	4.0	5.2	5.2	1.8	1.8	1.8
Max	67.0	65.0	70.0	65.0	65.0	70.0	4.0	0.0	0.0	40.0	40.0	40.0	10.0	10.0	10.0	3.8	3.8	3.8
Min	26.0	30.0	31.5	25.0	30.0	31.5	0.0	0.0	0.0	12.0	14.0	16.0	3.2	1.8	4.0	0.8	0.3	1.3
Average	32.1	37.8	20.3	31.4	37.8	20.3	0.8	0.0	0.0	17.0	22.1	11.0	3.9	5.7	3.0	1.8	1.9	0.9

Table M31.4.4 Monthly Water Quality of Assonora Water Treatment Plant, 30MLD Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

	Cl^- (mg/L)			Total Alkalinity as $CaCO_3$ (mg/L)			SO_4^- (mg/L)			Fe^{2+} (mg/L)			Mn^{2+} (mg/L)			NO_3^{2-} (mg/L)			$KMnO_4$ oxidizability as O_2 (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	6.0	6.0		12.0	13.0		0.0	0.0		0.05	0.05		0.00	0.00		0.6	0.0		0.2	0.0	
Feb-03	6.0	6.0		13.0	16.0		0.0	0.0		0.05	0.05		0.24	0.00		0.4	0.0		0.2	0.0	
Mar-03	6.0	6.0		16.0	29.0		0.0	0.0		0.06	0.05		0.00	0.00		1.3	0.0		0.2	0.0	
Apr-03	6.0	6.0		21.0	23.0		0.0	0.0		0.30	0.05		0.00	0.00		0.7	0.0		0.2	0.0	
May-03	6.0	6.0		23.0	23.0		0.0	0.0		0.06	0.05		0.00	0.00		0.4	0.0		0.2	0.0	
Jun-03	4.0	4.0		20.0	32.0		0.0	0.0		0.45	0.06		0.00	0.00		0.8	0.0		0.4	0.0	
Jul-03	6.0	6.0		16.0	20.0		0.0	0.0		0.10	0.05		0.00	0.00		0.9	0.0		0.3	0.0	
Aug-03	6.0	6.0		17.0	17.0		0.0	0.0		0.20	0.05		0.00	0.00		0.4	0.0		0.3	0.0	
Sep-03	6	6.0		17	20.0		0.0	0.0		0.05	0.05		0.00	0.00		0.8	0.0		0.2	0.0	
Oct-03	6.0	6.0		23.0	25.0		0.0	0.0		0.10	0.05		0.00	0.00		0.9	0.0		0.2	0.0	
Nov-03	6.0	6.0		20.0	23.0		0.0	0.0		0.05	0.05		0.10	0.00		0.4	0.0		0.2	0.0	
Dec-03	6.0	6.0		18.0	24.0		0.0	0.0		0.06	0.05		0.08	0.00		0.8	0.0		0.4	0.0	
Jan-04	6.0	6.0		18.0	26.0		0.0	0.0		0.10	0.05		0.00	0.00		1.9	0.0		0.4	0.0	
Feb-04	6.0	6.0		18.0	22.0		0.0	0.0		0.05	0.05		0.00	0.00		1.5	0.0		0.3	0.0	
Mar-04	6.0	6.0	6.0	20.0	23.0	23.0	0.0	0.0	0.0	0.12	0.05	0.05	0.00	0.00	0.00	1.2	0.0	0.0	0.3	0.0	0.0
Apr-04	6.0	6.0	6.0	21.0	35.0	32.0	0.0	0.0	0.0	0.08	0.05	0.05	0.00	0.00	0.00	1.0	0.0	0.0	0.3	0.0	0.0
May-04	7.0	7.0	9.0	44.0	44.4	44.0	0.0	0.0	0.0	0.60	0.10	0.10	0.00	0.00	0.00	1.4	0.0	0.0	0.6	0.0	0.0
Jun-04	7.0	7.0	7.0	15.0	18.0	18.0	0.0	0.0	0.0	0.06	0.05	0.05	0.00	0.00	0.00	0.6	0.0	0.0	0.2	0.0	0.0
Jul-04	7.0	7.0	7.0	17.0	28.0	28.0	0.0	0.0	0.0	0.30	0.05	0.05	0.12	0.00	0.00	0.8	0.0	0.0	0.4	0.0	0.0
Aug-04	6.0	6.0	7.0	17.0	18.0	18.0	0.0	0.0	0.0	0.20	0.10	0.10	0.00	0.00	0.00	0.5	0.0	0.0	0.3	0.0	0.0
Sep-04	6.0	6.0	7.0	16.0	21.0	21.0	0.0	0.0	0.0	0.06	0.06	0.06	0.00	0.00	0.00	0.4	0.0	0.0	0.2	0.0	0.0
Oct-04	6.0	6.0	6.0	18.0	19.0	19.0	0.0	0.0	0.0	0.06	0.05	0.05	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Nov-04	6.0	6.0	7.0	16.0	19.0	19.0	0.0	0.0	0.0	0.06	0.05	0.05	0.10	0.00	0.00	0.2	0.0	0.0	0.0	0.0	0.0
Dec-04	6.0	6.0	6.0	19.0	24.0	25.0	0.0	0.0	0.0	0.06	0.05	0.05	0.00	0.00	0.00	0.0	0.0	0.0	0.2	0.0	0.0
Jan-05	6.0	7.0	8.0	18.0	19.0	19.0	0.0	0.0	0.0	0.40	0.06	0.06	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Feb-05	6.0	6.0	6.0	17.0	21.0	21.0	0.0	0.0	0.0	0.06	0.05	0.05	0.00	0.00	0.00	0.6	0.0	0.0	0.3	0.0	0.0
Mar-05	7.0	7.0	7.0	16.0	20.0	20.0	0.0	0.0	0.0	0.10	0.06	0.06	0.00	0.00	0.00	0.4	0.0	0.0	0.2	0.0	0.0
Apr-05	7.0	7.0	8.0	17.0	25.0	25.0	0.0	0.0	0.0	0.10	0.06	0.06	0.12	0.00	0.00	0.5	0.0	0.0	0.3	0.0	0.0
May-05	6.0	8.0	10.0	17.0	18.0	18.0	0.0	0.0	0.0	0.20	0.10	0.10	0.00	0.00	0.00	0.8	0.0	0.0	0.3	0.0	0.0
Max	7.0	8.0	10.0	44.0	44.4	44.0	0.0	0.0	0.0	0.60	0.10	0.10	0.24	0.00	0.00	1.9	0.0	0.0	0.6	0.0	0.0
Min	4.0	4.0	6.0	12.0	13.0	18.0	0.0	0.0	0.0	0.05	0.05	0.05	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Average	6.1	6.2	3.7	18.6	22.9	12.1	0.0	0.0	0.0	0.14	0.06	0.03	0.03	0.00	0.00	0.7	0.0	0.0	0.3	0.0	0.0

	BOD at 27°C and 3days (mg/L)			DO (mg/L)			F^- (mg/L)			Al^{3+} (mg/L)			Plate Count on nutrient agar no/100mL			MPN of Coliform no/100mL			MPN of E.Coli. no/100mL		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0.5	0.0					0.0	0.0		0.0	0.00		0	0		0	0	0	0	0	0
Feb-03	0.5	0.0					0.0	0.0		0.0	0.00		0	0		0	0	0	0	0	0
Mar-03	0.5	0.0					0.0	0.0		0.0	0.00		86	2		1100	0	0	150	0	0
Apr-03	0.5	0.0					0.0	0.0		0.0	0.00		0	0		0	0	0	0	0	0
May-03	0.5	0.0					0.0	0.0		0.0	0.00		0	0		0	0	0	0	0	0
Jun-03	1.0	0.0					0.0	0.0		0.0	0.33		0	0		0	0	0	0	0	0
Jul-03	1.0	0.0					0.0	0.0		0.0	0.21		0	0		0	0	0	0	0	0
Aug-03	0.5	0.0					0.0	0.0		0.0	0.04		127	3		150	0	0	93	0	0
Sep-03	0.5	0.0					0.0	0.0		0.0	0.02		140	1		93	0	0	43	0	0
Oct-03	0.5	0.0		7.1	7.2		0.0	0.0		0.0	0.04		137	0		460	0	0	240	0	0
Nov-03	0.5	0.0		7.1	7.2		0.0	0.0		0.0	0.04		70	28	1	430	0	0	230	0	0
Dec-03	1.9	0.0		7.2			0.0	0.0		0.0	0.05		82	13	0	460	23	0	460	0	0
Jan-04	1.2	0.0		7.3	7.4		0.0	0.0		0.0	0.00		82	13	0	460	23	0	460	0	0
Feb-04	0.8	0.0		7.3	7.4		0.0	0.0		0.0	0.00		88	40	0	460	460	0	460	240	0
Mar-04	0.8	0.0	0.0	7.2	7.3	7.3	0.0	0.0	0.0	0.0	0.00	0.00	104	4	2	43	0	0	23	0	0
Apr-04	0.6	0.0	0.0	7.2	7.4	7.5	0.0	0.0	0.0	0.0	0.00	0.00	135	75	2	240	93	0	9	7	0
May-04	1.2	0.0	0.0	6.9	7.0	7.2	0.0	0.0	0.0	0.0	0.00	0.00	107	67	2	1100	460	0	460	93	0
Jun-04	0.6	0.0	0.0	6.9	7.5	7.5	0.0	0.0	0.0	0.0	0.00	0.00	87	12	1	240	4	0	240	0	0
Jul-04	1.1	0.0	0.0	7.1	7.2	7.2	0.0	0.0	0.0	0.0	0.10	0.1	220	140	3	93	93	0	43	21	0
Aug-04	0.5	0.0	0.0	7.0	7.3	7.4	0.0	0.0	0.0	0.0	0.05	0.05	123	12	0	240	43	0	93	0	0
Sep-04	0.5	0.0	0.0	7.0	7.4	7.4	0.0	0.0	0.0	0.0	0.05	0.05	192	15	0	240	21	0	21	0	0
Oct-04	0.0	0.0	0.0	7.2	7.4	7.4	0.0	0.0	0.0	0.0	0.04	0.04	180	4	0	460	9	0	240	0	0
Nov-04	0.0	0.0	0.0	7.1	7.3	7.4	0.0	0.0	0.0	0.0	0.01	0.01	140	25	2	460	39	0	21	7	0
Dec-04	0.5	0.0	0.0	7.5	7.6	7.6	0.0	0.0	0.0	0.0	0.01	0.01	71	12	2	1100	23	0	240	4	0
Jan-05	0.0	0.0	0.0	7.5	7.6	7.6	0.0	0.0	0.0	0.0	0.01	0.01	88	5	3	93	0	0	28	0	0
Feb-05	0.5	0.0	0.0	7.3	7.5	7.5	0.0	0.0	0.0	0.0	0.00	0.00	45	35	2	93	4	0	0	0	0
Mar-05	0.5	0.0	0.0	7.5	7.8	7.8	0.0	0.0	0.0	0.0	0.00	0.00	112	12	0	93	15	0	23	0	0
Apr-05	0.5	0.0	0.0	7.4	7.6	7.6	0.0	0.0	0.0	0.0	0.00	0.00	178	15	2	460	4	0	240	0	0
May-05	0.6	0.0	0.0	7.0	7.2	7.2	0.0	0.0	0.0	0.0	0.02	0.02	120	35	0	1100	3	0	23	0	0
Max	1.9	0.0	0.0	7.5	7.8	7.8	0.0	0.0	0.0	0.0	0.3	0.1	220	140	3	1100	460	0	460	240	0
Min	0.0	0.0	0.0	6.9	7.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0
Average	0.6	0.0	0.0	5.0	4.8	3.8	0.0	0.0	0.0	0.0	0.0	0.0	93.6	19.6	0.8	333.4	45.4	0.0	132.4	12.8	0.0

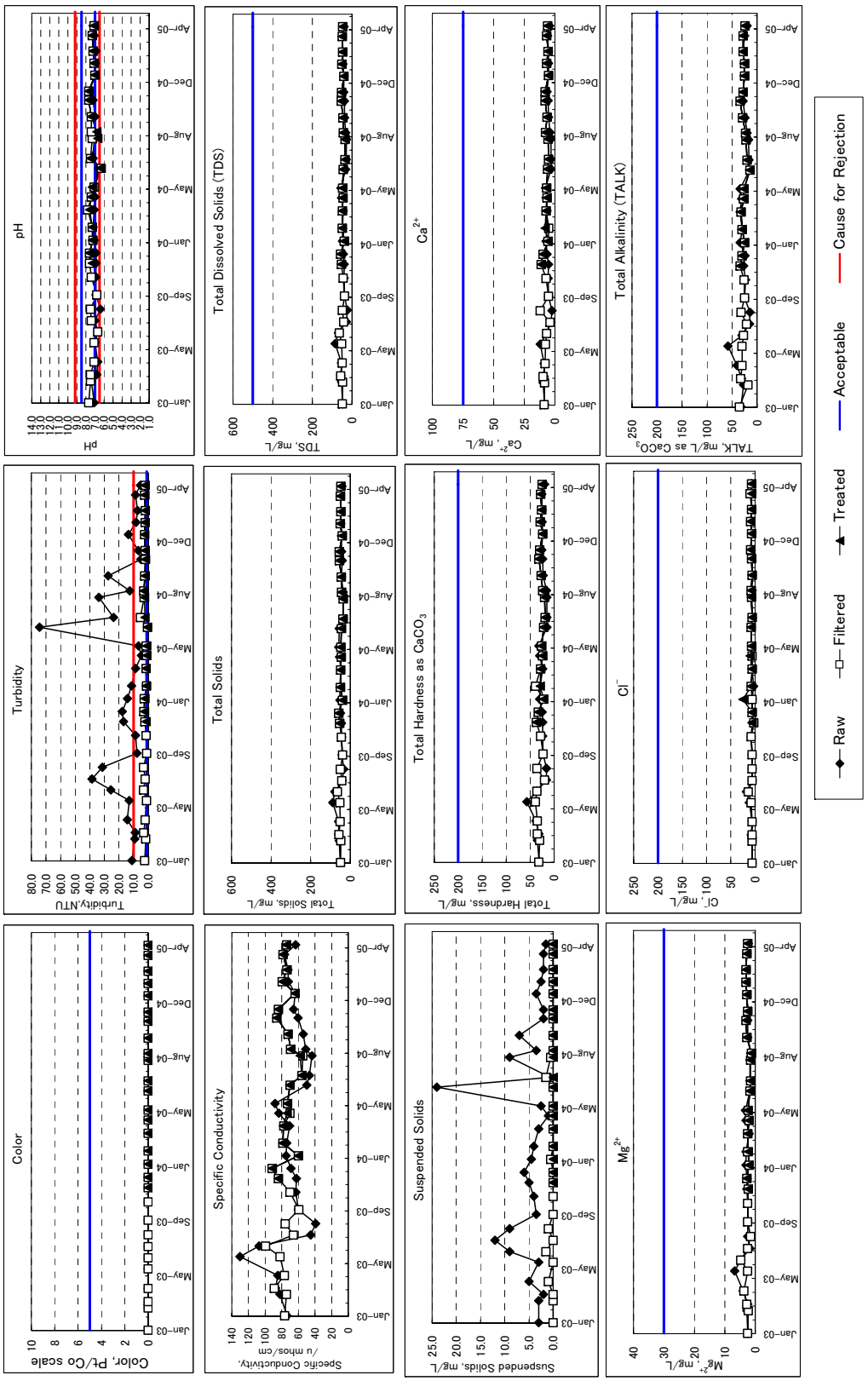

Figure M31.4.3 Monthly Water Quality of Assonora Water Treatment Plant, 30MLD Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

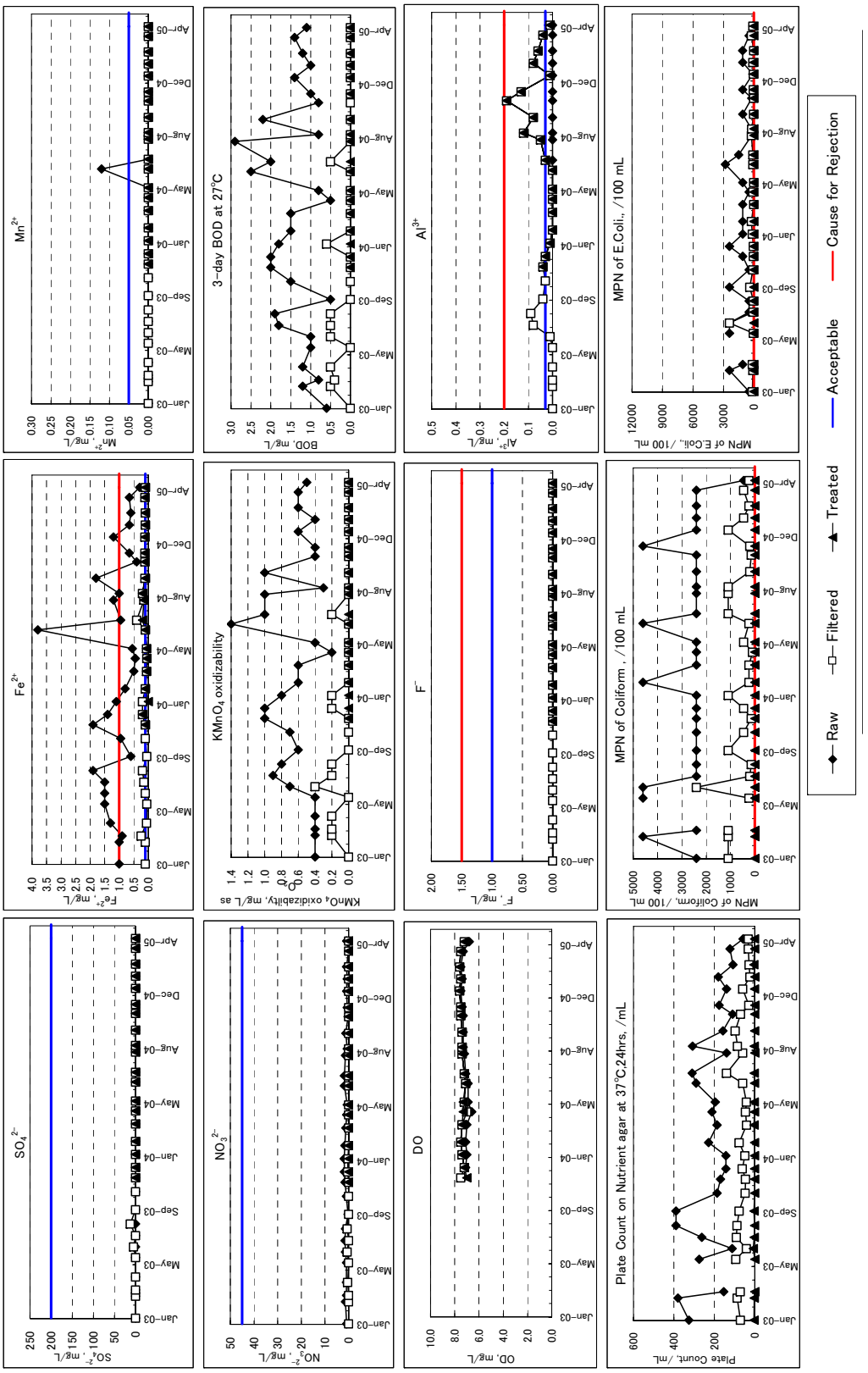

Figure M31.4.3 Monthly Water Quality of Assonora Water Treatment Plant, 30MLD Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

Table M31.4.5 List of Reservoirs for the Assonora Water Supply Scheme (1/3)

Series No.	System	Name of GLR / OHR (Name of Location)	GLR/OHR					Supply Area		Remarks
			Type	Capacity (m3)	Elevation (m)			Taluka	Village Name	
					RL	HWL	LWL			
1	Assonora WTP	Assonora WTP	GLR	1,200	15.00					
2			GLR	1,000						
3			GLR	1,000						
4			GLR	2,000						
		Sub-Total		**5,200**						
5	Assonora MBR	Assonora MBR	GLR	800	120.00	124.00	120.00			
6			GLR	800						
7			GLR	800						
8			GLR	800						
9			GLR	5,000						
		Sub-Total		**8,200**						
10	350 (Old)	Sirsaim	GLR	300	48.60	52.60	48.90	Bardez	Sircaim(8)	
11		Cansa-Bodiem	GLR	50	46.80	49.30	47.10	-ditto-	Tivim(9)	
12		Colvale	GLR	150	50.00	54.00	50.30	-ditto-	Colvale(CT)(35)	
13		Tivim-IDC	OHR	150	50.00	69.00	65.00	-ditto-	Tivim(9), Mapusa(M Cl)(36)	
14		Verla-Canca	GLR	150	65.00	69.00	65.30	-ditto-	Verka(16), Canca(17)	
15			GLR	800	65.00	69.00	65.30	-ditto-		
16		Parra	GLR	150	42.00	46.00	42.30	-ditto-	Parra(15)	
		Sub-Total		**1,750**						
17	400	Quitula	GLR	50	47.00	49.50	47.30	Bardez	Aldona(CT)(44)	
18		Aldona	GLR	50	33.46	37.46	33.76	-ditto-	Ponolem(25), Calvim(26), Aldona(CT)(44)	
19			GLR	300	33.46	37.46	33.76	-ditto-		
20		Khorjuem	GLR	150	29.10	33.10	29.40	-ditto-	Corjuem(24)	
21		Nachinola	OHR	50	25.20	44.20	41.20	-ditto-	Nachinola(23)	
22			OHR	150	48.45	67.45	64.45	-ditto-		
23			GLR	300	25.20	29.20	25.20	-ditto-		
24		Moira	OHR	150	47.00	66.00	63.00	-ditto-	Moira(22)	
25		Lakuem	GLR	300	38.15	42.15	38.45	-ditto-	Aldona(CT)(44)	
26		Olaulim	GLR	150	66.00	70.00	66.00	-ditto-	Olaulim(27),	
27		Pomburpa	GLR	300	53.11	57.11	53.41	-ditto-	Pomburpa(28)	
28		Ecoxim	GLR	300	38.15	42.15	38.45	-ditto-	Pomburpa(28)	
29		Salai	GLR	150	56.42	60.42	56.72	-ditto-	Salvador do Mundo(33)	
30			GLR	800	56.42	60.42	56.72	-ditto-		
		Sub-Total		**3,200**						

Table M31.4.5 List of Reservoirs for the Assonora Water Supply Scheme (2/3)

Series No.	System	Name of GLR / OHR (Name of Location)	GLR/OHR					Supply Area		Remarks
			Type	Capacity (m3)	Elevation (m)					
					RL	HWL	LWL	Taluka	Village Name	
31		Assonora	GLR	150	80.00	84.00	80.30	Bardez	Moitem(6), Assonora(7)	
32		Tivim	GLR	350	51.00	55.00	51.00	-ditto-	Tivim(9)	
33		Accoi	OHR	150	47.00	66.00	63.00	-ditto-	Mapusa(M CI)(36)	
34		Khorlim	GLR	300	78.00	82.00	78.30	-ditto-	Mapusa(M CI)(36)	
35		Bastora	GLR	250	46.00	50.00	46.30	-ditto-	Bastora(18), Paliem(19), Punola(20), Ucassaim(21)	
36		Anjuna	GLR	800	49.00	53.00	49.30	-ditto-	Assagao(11)	
37		Girim	GLR	150	42.00	46.00	42.30	-ditto-	Guirim(CT)(37)	
38			OHR	650	42.00	71.00	68.00	-ditto-	Guirim(CT)(37)	
39		Calangute	OHR	150	25.00	44.00	40.00	-ditto-	Calangute(CT)(39)	
40		Torda	OHR	800	60.00	84.00	80.00	-ditto-	Salvador do Mundo(33), Penha-de-Franca(CT)(42),	
41	700		GLR	300	60.00	64.00	60.30	-ditto-	Socorro(Serula)(CT)(43)	w / Pump
42		Porvolim	OHR	150	58.00	77.00	73.00	-ditto-	Pilerne(32), Socorro(Serula)(CT)(43)	
43			GLR	800	58.00	62.00	58.00	-ditto-		w / Pump
44		Pilerna	GLR	150	50.00	54.00	50.30	-ditto-	Marra(31), Pilerne(32)	
45		Verem	GLR	250	70.00	74.00	70.30	-ditto-	Reis Magos(CT)(41)	
46		Alto-Betim	GLR	150	55.00	59.00	55.30	-ditto-	Reis Magos(CT)(41)	
47		Pundalik Nagar	GLR	300	55.00	59.00	55.30	-ditto-	Penha-de-Franca(CT)(42)	w / Pump
48			OHR	300	55.00	74.00	70.00	-ditto-		
49		Secretariate Complex	GLR					-ditto-	≒200 m^3/day	
50		Nerul	GLR	150	55.00	59.00	55.30	-ditto-	Nerul(30)	
		Sub-Total		**6,300**						
51		Pirna	GLR	50	41.00	45.00	41.30	Bardez		
52			GLR	150	41.00	45.00	41.30	-ditto-	Pirna(5)	
53			GLR	300	41.00	45.00	41.30	-ditto-		
54		Nadora	GLR	100	48.00	52.00	48.30	-ditto-	Nadora(4)	
55			GLR	300	48.00	52.00	48.30	-ditto-		
56		Revora	GLR	50	49.00	53.00	49.30	-ditto-	Revora(3)	
57			GLR	300	49.00	53.00	49.30	-ditto-		
58	1100	Colvale	GLR	300	48.00	52.00	48.30	-ditto-	Colvale(CT)(35)	
59		Chicalim	GLR	150	50.00	54.00	50.30	-ditto-	Camurlim(2)	
60		Camurlim	GLR	300	48.00	52.00	48.30	-ditto-	Camurlim(2)	
61		Cuchelim	GLR	150	49.00	53.00	49.30	-ditto-	Mapusa(M CI)(36)	
62		Sodiem	GLR	300	51.00	55.00	51.30	-ditto-	Siolim(CT)(34),	
63		Oxel	GLR	300	49.00	53.00	49.30	-ditto-	Oxel(1)	
64		Peddem	OHR	300	50.00	69.00	66.00	-ditto-	Mapusa(M CI)(36)	
65		Marna	GLR	150	78.00	82.00	78.30	-ditto-	Marna(10)	

Table M31.4.5 List of Reservoirs for the Assonora Water Supply Scheme (3/3)

Series No.	System	Name of GLR / OHR (Name of Location)	GLR/OHR					Supply Area		Remarks
			Type	Capacity (m3)	Elevation (m)			Taluka	Village Name	
					RL	HWL	LWL			
66	1100	Siolim	GLR	150	50.00	54.00	50.30	-ditto-	Siolim(CT)(34),	
67			GLR	800	50.00	54.00	50.30	-ditto-		
68		Ucassaim	GLR	300	47.00	51.00	47.30	-ditto-	Uassaim(21)	
69		Assagao	GLR	800	48.00	52.00	48.30	-ditto-	Assagao(11)	
70		Vagator	GLR	800	40.00	44.00	40.30	-ditto-	Anjuna(12)	
71		Arpora	GLR	250	50.00	54.00	50.30	-ditto-	Arpora(13), Nagoa(14)	
72		Calangute	GLR	800	30.00	34.00	30.30	-ditto-	Calangute(CT)(39)	
73		Candolim	GLR	150	40.00	44.00	40.30	-ditto-	Candolim(CT)(40)	
74			GLR	800	40.00	44.00	40.30	-ditto-		
75		Sinquelim	GLR	800	48.00	52.00	48.30	-ditto-	Candolim(CT)(40)	
76			GLR	150	30.00	34.00	30.30	-ditto-		
77		Saligao	GLR	800	48.00	52.00	48.30	-ditto-	Saligao(CT)(38)	
78		Sangolda	GLR	300	48.00	52.00	48.30	-ditto-	Sangolda(29)	
79		Vadiem	GLR	150	50.00	54.00	50.30	-ditto-	Socorro(Serula)(CT)(43)	
80		Socorro	OHR	150	55.00	74.00	70.00	-ditto-		
81			GLR	150	55.00	59.00	55.30	-ditto-	Socorro(Serula)(CT)(43), Sangolda(29)	
82			Sump	300	55.00			-ditto-		w / Pump
		Sub-Total		**10,850**						
83	1200 P/Main	Housing Board	OHR	100	87.00	106.00	103.00	Bardez		
84			OHR	150	85.00	104.00	101.00	-ditto-		
85			OHR	300	87.00	107.00	103.00	-ditto-		
86		Mapusa	GLR	2,000	75.00	79.00	75.30	-ditto-		
87			GLR	800	80.00	84.00	80.30	-ditto-	Mapusa(M CI)(36)	
88			GLR	650	67.00	71.00	67.30	-ditto-		w / Pump
89			GLR	650	67.00	71.00	67.30	-ditto-		
90		Mapusa (Altinho)	GLR	300	85.00	89.00	85.30	-ditto-		
91			GLR	800	85.00	89.00	85.30	-ditto-		
92		Assagao	GLR	150	66.00	70.00	66.30	-ditto-	Assagao(11), Parra(15), Verla(16), Canca(17), Mapusa(M CI)(36)	
93		P.D.A. Colony	OHR	3,000	80.00	84.00	80.00	-ditto-	Pilerne(32), Reis Magos(CT)(41), Penha-de-Franca(CT)(42)	
		Sub-Total		**8,900**						
94	Assonora North (Bicholim Taluka)	Sirigao	GLR	50	51.00	55.00	51.30	Bicholim	Sirigao(6), Maem(12)	
95		Usap	GLR	800	41.00	45.00	41.30	-ditto-	Adwalpale(5), Sirigao(6)	
		Sub-Total		**850**						
		Total		**45,250**						
				19.1	**hrs**					

Note: RL=Reduced Elevation, HWL=High Water Level in Reservoir, LWL=Low Water Level in Reservoir, GLR=Ground Level Reservoir, OHR=Over Head Reservoir, MBR=Master Balancing Reservoir

M31.5 Sanquelim Water Supply Scheme

Table M31.5.1 lists the summary of asset data for the WTP and Table M31.5.2 contains detailed asset data for the WTP. The plant schematic is shown on Figure M31.5.1. Tables M31.5.3 and M31.5.4 and Figures M31.5.2 and M31.5.3 show the data on monthly water quality at Chandel Water Treatment Plant. Table M31.5.5 shows a list of existing reservoirs for Sanquelim Water Supply Scheme.

Podocem WTP

The Podocem WTP was built recently (2003) and has a design capacity of 40 MLD. The newly constructed raw water pump house supplies the plant with water from the Valvant River. The water is pumped approximately 0.6 km from the river. There are three pumps (two duty). These pumps are not adequately guarded. A record of running hours, loads etc. is logged. The operation and maintenance of the pump house and treatment plant has been contracted to a local company (run by a retired PHE engineer) on a three monthly basis. This may be revised to be a longer contract (2-5 years).

The pump house compound also contains a pump house that was commissioned in 1992. It contains two pumps (one duty). These pumps are not adequately guarded. This pump house supplys 25 MLD to the Assonora WTP via a short rising main to a reservoir. The water is fed by gravity from the reservoir to the Assonora WTP which is located approximately 20 km away. A log of running hours, loads etc. is maintained.

A third pump house, which contains two pumps (one duty) was commissioned in 1972. This pump house supplies water to the 12 MLD Sanquelim WTP via a 0.6 km rising main. This pump house is untidy and the pumps are not adequately guarded. A log of running hours, loads etc. is maintained.

Both the raw water pumping compound and the treatment plant compound are adequately gated, fenced and secured by 24 hour on-site security personnel. The plant is in operation 24 hours a day using a three shift system.

Flow measurement devices are not provided on-site. Therefore, the amount of raw water supplied to the plant, as well as the amount of clean water fed to the transmission system via the clean water reservoirs, is estimated based on pump design capacities and hours of operation.

Logs are maintained for pump running hours, loads etc, however maintenance records are not

kept. There is a well established system of monthly oiling and greasing. However, other maintenance is reactive. No operation and maintenance manuals are available. Training for new staff is only provided on the job by existing experienced staff. There are no written or formal safety systems for plant operation.

The treatment plant is manually controlled but the valves are operated remotely by pneumatic actuators. The plant is new and appears to be in good working order, including the alum and lime mixers. Generally, the maintenance standards are good, however the pump couplings/shafts are not adequately guarded.

Logs are kept for pump running hours, load, filter backwashing, and clear water reservoir levels. However, there are no maintenance logs recording repairs to assets or maintenance/breakdown problems. Logs are kept by the laboratory staff for chemical usage and treatment parameters.

Disinfection is achieved using gas chlorination. The chlorination uses one tonne cylinders. There are usually two cylinders in the chlorine house at any one time. There are two vacuum type chlorinators (Metito Mach4). Maintenance of the chlorinators is performed in-house, however the chlorinators are not periodically calibrated and records of maintenance are not kept. Operation and maintenance practices for chlorine use are poor. Ammonia solution is used to detect leaks from the pipe and from the connection joints. There are no facilities to adequately detect or contain gas leaks, in particular, no immersion tank is available. Personal breathing apparatus is available in the laboratory but is not used or maintained. The copper connection pipes are repaired locally and appear to be in poor condition. These existing pipes should be discarded and not repaired. The galvanised iron feed pipe to the contact tank is badly corroded and should be replaced.

The clean water reservoirs are cleaned annually. During cleaning, the covers are removed to aid natural ventilation and to allow the workers to enter. The workers undertake the sludge removal and flushing. There are no safety precautions, safety equipment or safety systems.

Sanquelim WTP

The WTP consists of a 7 MLD plant and a 5 MLD plant. Both of these plants were commissioned around 1972. The plants are manually operated. Despite their age, the plants appear to be in good working condition. Maintenance standards appear to be reasonable across the site, except for the chemical mixing areas. The chlorine house is equipped with a one tonne cylinder and one vacuum type chlorinator. There are no standbys. Logs are maintained for pump run hours, load, chemical use and treatment parameters.

Table M31.5.1 Summary of Asset Register of Sanquelim Water Treatment Plant

(1) Sanquelim Plant, 5MLD and 7MLD

Name of Facility		5 MLD		7 MLD	
		Contents of Facility	Remarks	Contents of Facility	Remarks
Raw Water Intake & Raw Water Transmission Facility	Connecting Pipe & Jack Well	D500mm × CIP × 1 Line, Jack Well: D6.2 m			Valvant River
	Pump & Motor	Vertical Pump: ^{Q}216m^3/hr×^{H}75m×75kw×1 unit, ^{Q}324m^3/hr×^{H}75m×100kw×2 units, ^{Q}375m^3/hr×^{H}75m×110kw×1 unit (1 or 2 – Standby)			Design Cap. of Intake Pump = 13～16MLD
	Raw Water Transmission Main	D350mm × 600m × C.I.P. ×1 Line		D450mm × 600m × C.I.P./M.S.P. ×1 Line	
Treatment Facility	Aerator	Cascade Type: 1 unit		Cascade Type: 1 unit	
	Parshal Flume	1 unit (for Chemical Dosing)		1 unit (for Chemical Dosing)	
	Clariflocculator	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: ^{D}13.6m (Flocc. Zone 3.4m) × ^{WD}3.2m × 1 unit Detention Period: Flocculation – 8.0min Clarifier – 2.0 hrs Surface Loading: 38.6 m^3/m^2/d (26.8 mm/min) [2]	1): 2～2.5 hrs 2): 30～40m^3/m^2/d	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: ^{D}20.0m (Flocc. Zone 5.0m) × ^{WD}3.35m × 1 unit Detention Period: Flocculation – 12.9min Clarifier – 3.2hrs Surface Loading: 24.9 m^3/m^2/d (17.3 mm/min) [2]	1): 2～2.5 hrs 2): 30～40m^3/m^2/d
	Filter	Gravity Rapid Sand Filter Type ^{W}5.55m × ^{L}5.0m × 2cells/basin × 2 basins Effective Size of Sand: 0.??mm, Depth of Sand: 0.65m Filter Area: 13.9 m^2/cell, 27.8 m^2/basin Filtration Rate: 3.9 m/hr [3] (94.6 m/d) Air Scouring Rate: ??m/hr/cell [4] (?? m^3/min/m^2/cell) Backwash Rate: 8.4 m/hr/cell [5] (0.14 m^3/min/m^2/cell)	Based on Specifications of Air Blower & Backwash Pump 3): 4.8～6.0m/hr 4): 36～54m/hr 5): 24～36m/hr	Gravity Rapid Sand Filter Type ^{W}5.1m × ^{L}2.6m × 2cells/basin × 3 basins Effective Size of Sand: 0.??mm, Depth of Sand: 0.65m Filter Area: 6.65 m^2/cell, 13.3 m^2/basin Filtration Rate: 7.7 m/hr [3] (185 m/d) Air Scouring Rate: ??m/hr/cell [4] (?? m^3/min/m^2/cell) Backwash Rate: 12 m/hr/cell [5] (0.20 m^3/min/m^2/cell)	Based on Specifications of Air Blower & Backwash Pump 3): Higher than standard (4.8 ～ 6.0m/hr) 4): 36～54m/hr 5): 24～36m/hr
Chemical Feeding Facility	Alum Feeding Facility	Dry Aluminum Sulfate Solution Tank: 3 units		Dry Aluminum Sulfate Solution Tank: 3 units	
	Lime Feeding Facility	Powder Lime Solution Tank: 3 units		Powder Lime Solution Tank: 3 units	
	Disinfection Facility	Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 2 units		Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 2 units	
Laboratory	Frequency of Sampling & Analysis	Not In-Service, Jar Test: Not in Service Every Hour: pH, R-Cl Fortnightly: Turbidity, pH, Alkalinity, Hardness, Chlorine, Mn, Fe, D.O.,R-Cl			
Clear Water Transmission Facility	Clear Water Reservoir	Volume=800 m^3×1 unit, Retention Time:3.8 hr		Volume=1,000 m^3×1 unit, unit, Retention Time: 3.4 hr	
Note: 1) ～ 4) are referring to "Manual on Water Supply and Treatment, Third Edition – Revised and Updated, May 1999"					

(2) Podocem Plant, 40MLD

Name of Facility		Contents of Facility	Remarks
Raw Water Intake & Raw Water Transmission Facility	Intake Well	D8.0m × H 3.5m ×1 unit	Valvant River
	Connecting Pipe	D900mm × H 13m ×1 unit	
	Jack Well & P. H.	D8.0m × H 21.0m ×1 Line	
	Pump & Motor	Vertical Pump: $^{Q}835m^3/hr$ × $^{H}140.0m$ × 456kw × 3 units (1 – Standby)	Design Cap. of Intake Pump = 40MLD/system
	Rising Main	D750mm × 636m × M.S.P. ×1 Line	
Treatment Facility	Stilling Chamber	$^{W}3.0m$ ×$^{L}3.0m$ ×$^{WH}3.1m$ ×$^{Vol}27.9m^3$ × 1 unit ×^{RP} 1min	RP: Retention period
	Aerator	Cascade Type: 1 unit	
	Parshal Flume	1 unit (for Chemical Dosing)	
	Contact Aeration Tank	$^{D}17.0m$ ×$^{WH}5.0m$ × $^{Vol}1,135m^3$ × 1 unit × ^{RP} 38.9min	RP: Retention period
	Flash Mixer	1 unit with Flocculation Channel	
	Clarifier	Sludge Blanket Lamella Clarifier with PVC Tube Modules: $^{W}14.0m$ × $^{L}14.0m$ × $^{WH}5.0m$ × 2 units Detention Period: Clarifier – 1.1 hrs [1] Surface Loading for Clarifier: 107.1 $m^3/m^2/d$ (74.4 mm/min) [2]	1): 2～2.5 hrs 2): 30～40$m^3/m^2/d$
	Filter	Gravity Rapid Sand Filter Type $^{W}4.5m$ × $^{L}9.5m$ × 2cells/basin × 4 basins Effective Size of Sand:0.??mm, Depth of Sand: 0.??m Filter Area: 21.4 m^2/cell, 42.8 m^2/basin Filtration Rate: 10.2 m/hr [3] (245 m/d) Air Scouring Rate: 7.2m/hr/cell [4]) (0.12$m^3/min/m^2$/cell) Backwash Rate: 28.2m/hr/cell [5] (0.47$m^3/min/m^2$/cell) – using 600m3 Backwash Tank	Based on Specifications of Air Blower & Backwash Pump 3): Higher than Standard(4.8 ～ 6.0m/hr) 4): 36～54m/hr 5): 24～36m/hr
	Dirty Water Sump	$^{D}13.0m$ ×$^{WH}1.5m$ × $^{Vol}199m^3$ × 1 unit	
Clear Water Transmission Facility	Parshal Flume	1unit for Post-Chlorination	
	Clear Water Reservoir	Total Volume=5,000 m × 2units Retention Time: 4.6 hr	
Chemical Feeding Facility	Alum Feeding Facility	Dry Aluminum Sulfate Solution Tank: 3 units	
	Lime Feeding Facility	Powder Lime Solution Tank: 3 units	
	Disinfection Facility	Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 3 units	
Laboratory	Frequency of Sampling & Analysis	In-Service, Jar Test: Not in Service Every Hour: pH, Turbidity, R-Cl, D.O. Fortnightly: 20 Parameters	
Note: 1) ～ 4) are referring to "Manual on Water Supply and Treatment, Third Edition – Revised and Updated, May 1999"			

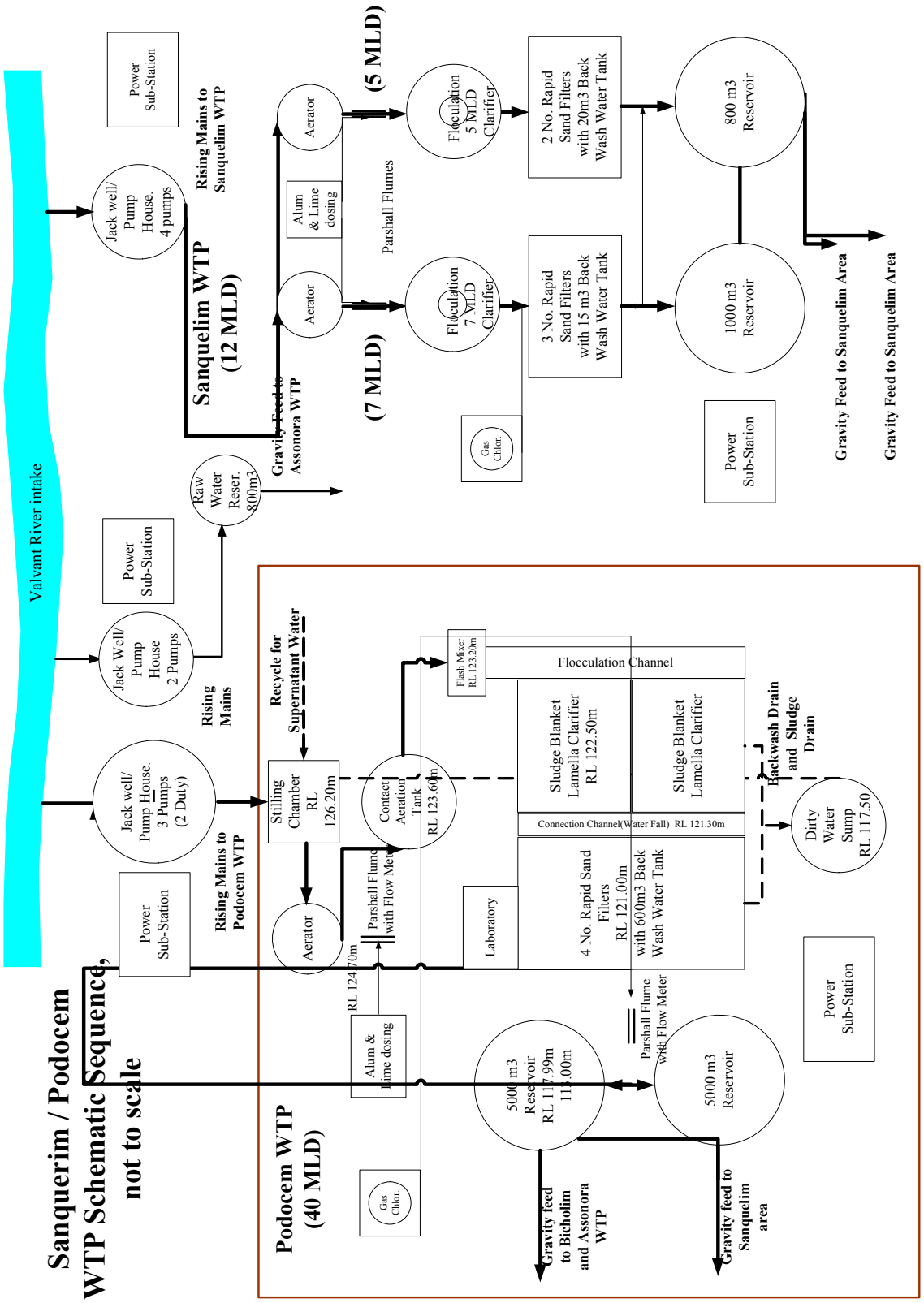

Figure M31.5.1 Schematic Sequence of Sanquelim Water Treatment Plant

Table M31.5.2 Present Conditions of Sanquelim Water Treatment Plant (1/9)

Item		Sanwuelim W.T.P. (1)	Sanwuelim W.T.P. (2)	Total	Podocem W.T.P. (3)	TOTAL	Remarks
Background							
Covered Area for Water Supply	Taluka	Part of Bicholim, Tiswadi & Sattari					
Name of Plant		Sanwuelim W.T.P.			Podocem W.T.P.	TOTAL	
Number of W.T.P.	Number	(1)	(2)	Total	(3)		
Capacity of Plant	MLD	5	7		40	52	to Assonara
	m^3/d	5,000	7,000		40,000	52,000	
Raw Water Resources	River	Valvant	Valvant		Valvant		
	Dam						
Year of Construction	Year				2001 - 2002		
Year of Commission	Year	1975	1994		2003		

Name & Number of W.T.P.	Number	Sanquelim W.T.P. (1)	Sanquelim W.T.P. (2)	Total	Podocem W.T.P. (3)	TOTAL	Remarks
Design Capacity of Raw Water Intake & Treated Facility	MLD	5.25	7.35	12.60	42.00	54.60	:5% Losses of Nominal Capacity
	m^3/d	5,250	7,350	12,600	42,000	54,600	

Name of Facility			Sanwuelim W.T.P. (1) 5 MLD		Sanwuelim W.T.P. (2) 7 MLD		Total	Podocem W.T.P. (3) 40 MLD			TOTAL	Remarks
Head Water Works : Raw Water Int												
Intake Well	Diameter	m	4.0	-	-	-	-	8.0	-	-		
	Height	m	-	-	-	-	-	3.5	-	-		
	Water Level		-	-	-	-	-	-	-	-		
	HWL	m	-	-	-	-	-	7.20	-	-		
	MWL	m	-	-	-	-	-	3.00	-	-		
	Volume	m^3/unit	-	-	-	-	-	175.9	-	-		
Connecting Pipe	Diameter	mm	500	-	-	-	-	900	-	-		
	Length	m		-	-	-	-	13.0	-	-		
	Material		CIP	-	-	-	-	-	-	-		
	Velocity	m/sec	0.155	-	-	-	-	0.688	-	-		
	Loss of Head	m	0.000					0.010				C=110
Jack Well & Pump House	Diameter	m	6.20	-	-	-	-	8.00	-	-		
	Water Depth	m	-	-	-	-	-	10.70	-	-		
	Height	m	-	-	-	-	-	21.50	-	-		
	Inlet Gate	unit	3						-	-		
	Volume	m^3/unit	-	-	-	-	-	537.8	-	-		
	Detension Time	min	-	-	-	-	-	18.4	-	-		
M.C.C. & Store Room	Width	m	3.00	-	-	-	-					
	Length	m	7.00	-	-	-	-					
	Area of Floor	m^2	21.0	-	-	-	-	96.0				
Raw Water Pump			5 MLD & 7 MLD						Raw Water to Assonora WTP			
	Capacity	ℓ/sec	60.0	90.0	104.2			231.9				
		m^3/min	3.60	5.40	6.25			13.92				
		m^3/hr	216.0	324.0	375.0			835.0				
		m^3/d	5,184	7,776	9,000			20,040				
	Number	unit	1	2	1			3	2			
	Stand-by	unit	0	1	1		2 Pumps Duty	1		Raw Water Res. $800m^3$		
	Total Capacity	m^3/d	12,960					40,080				
	Head	m	75.0	75.0	75.0			140.0				
	Maker		Worthington	Worthington	Worthington			N.G.E.F.				
	Year of Manufacture		1994	1994	1994			2003	1993			
	Assessment of Condition		Working, Valves Leakage					Working	Working			

Table M31.5.2 Present Conditions of Sanquelim Water Treatment Plant (2/9)

Name of Facility				Contents of Facility							Remarks
				Sanquelim W.T.P.				Podocem W.T.P.		TOTAL	
				(1) 5 MLD		(2) 7 MLD	Total	(3) 40 MLD			
				5 MLD & 7 MLD				Raw Water to Assonora WTI			
Raw Water Motor	Motor Output	HP		101	134	148		611	938		
		kW		75	100	110		456	700		
	Number	Unit		1	2	1		3	2		
	Maker			Kirlosker	Kirlosker	Kirlosker		Kirlosker	CROMPTON		
	Year of Manufacture			1994	1994	1994		2003	1993		
	Assessment of Condition			Working				Working	Working		
Raw Water Rising Main	Diameter	mm		350		450		750			
	Length	m		600		600		636			
	Material			CIP		MS + CI		DIP K - 9			
	Velocity	m/sec		0.221		0.241		0.825			
	Loss of Head	m		0.999		0.548		1.213			
	Assessment of Condition	Pipe	Good		Good			Good			
		Valve	Good		Good			Good			
Stilling Chamber	Dsign Capacity	m^3/min/unit		-	-	-	-	29.17			
		m^3/hr/unit		-	-	-	-	1,750.0			
		m^3/d/unit		-	-	-	-	42,000			
	Number	Unit		-	-	-	-	1			
	Width	m		-	-	-	-	3.00			
	Length	m		-	-	-	-	3.00			
	Water Depth	m		-	-	-	-	3.10			
	Volume	m^3		-	-	-	-	27.9			
	Retention Time	min		-	-	-	-	0.96			
	Water Level	m		-	-	-	-	126.20			
	Assessment of Condition			-	-	-	-	Working			
Aerator	Capacity	m^3/hr/unit		218.8		306.3		1,750.0			
		m^3/d/unit		5,250		7,350		42,000.0			
	Number	Unit		1		1		1			
	Diameter	m		4.40		5.00		8.00 Cascade Aearator w/ Stilling			
	Height	m		4.00		4.00		2.90 Chamber & Contact Aeration			
	El. of Top Aerat	m						125.70			
	Assessment of Condition			Working		Working		Working			
Parshal Flume											
	Assessment of Condition			Working		Working		Working			

Table M31.5.2 Present Conditions of Sanquelim Water Treatment Plant (3/9)

Name of Facility			Contents of Facility					Remarks
			Sanquelim W.T.P.			Podocem W.T.P.	TOTAL	
			(1) 5 MLD	(2) 7 MLD	Total	(3) 40 MLD		
	Contact Aeration Tank	Dsign Capacity	m^3/min/unit	-	-	-	29.17	
			m^3/hr/unit	-	-	-	1,750.0	
			m^3/d/unit	-	-	-	42,000	
		Number	Unit	-	-	-	1	
		Diameter	m	-	-	-	17.00	
		Water Depth	m	-	-	-	5.0	
		Volume	m^3	-	-	-	1,134.9	
		Retention Time	min	-	-	-	38.9	
		Water Level	m	-	-	-	123.60	
		Assessment of Condition		-	-	-	Working	
	Flash Mixing Basin	Dsign Capacity	m^3/min/unit	-	-	-	29.17	
			m^3/hr/unit	-	-	-	1,750.0	
			m^3/d/unit	-	-	-	42,000	
		Number	Unit	-	-	-	1	
		Width	m	-	-	-	3.00	
		Length	m	-	-	-	3.00	
		Water Depth	m	-	-	-	3.10	
		Volume	m^3	-	-	-	27.9	
		Retention Time	min	-	-	-	0.96	
		Water Level	m	-	-	-	123.20	
		Assessment of Condition		-	-	-	Working	
	Flash Mixer							
		Assessment of Condition		-	-	-	Working	

Table M31.5.2 Present Conditions of Sanquelim Water Treatment Plant (4/9)

Name of Facility			Contents of Facility					Remarks
			Sanquelim W.T.P.			Podocem W.T.P.	TOTAL	
			(1) 5 MLD	(2) 7 MLD	Total	(3) 40 MLD		
Clarifiers / Settling Tank (Coagulation Basin)	Dsign Capacity	m^3/min/unit	3.6	5.1		14.6		
		m^3/hr/unit	218.8	306.3		875.0		
		m^3/d/unit	5,250	7,350		21,000		
	Number	Unit	1	1		2		
	Type of Clarifier		Circular Horizontal Flow Type with Center Feed/Peripheral Collection			Sludge Blanket Lamella Clarifier with PVC Tube Modules		
	Width	m	-	-		14.00		20.00
	Length	m	-	-		14.00		10.50
	Water Depth	m	3.20	3.35		5.00		4.50
	Overall Diameter	m	13.60	20.00		-		
	Flocc. Zone Dia.	m	3.40	5.00		-		
	Frequency of Desludging		General season: Once a day Monsoon Season: Twice a day at Monsoon					
	Volume							
	Overall	m^3/unit	464.9	1,052.4		980.0		945.0
	Flocculation Zone	m^3/unit	29.1	65.8		-		
	Clarifying Zone	m^3/unit	435.8	986.7		-		
	Retention Time							
	Flocculation Zone	min	8.0	12.9		-		
	Clarifying Zone	min	119.5 OK	193.3 OK		-		
	Overall	min	127.5	206.2		67.2 OK		
	Surface Area	m^2/unit	136.2	294.5		196.0		
	Surface Loading	mm/min	26.8 OK	17.3 OK		74.40 ?		
	W.L. of Clarifier	m				122.50		
	Assessment of Condition		Working	Working		Working		
Flocculator	Number	unit				-		
	Assessment of Condition		Working	Working				
Drive Arrangement	Number	unit				-		
	Assessment of Condition		Working	Working				

Table M31.5.2 Present Conditions of Sanquelim Water Treatment Plant (5/9)

Name of Facility				Contents of Facility					Remarks
				Sanquelim W.T.P.			Podocem W.T.P.	TOTAL	
				(1) 5 MLD	(2) 7 MLD	Total	(3) 40 MLD		
	Filter	Design Capacity	m^3/hr/unit	109.4	102.1		437.5		
			m^3/d/unit	2,625	2,450		10,500		
		Number	Unit	2	3		4		
		Type		Rapid Sand Gravity	Rapid Sand Gravity		Rapid Sand Gravity		
				w /20 m3 Backwash Tank	w /15 m3 Backwash Tank		w /600 m3 Backwash Tank		
		Width	m	5.55	5.10		9.50		
		Length	m	5.00	2.60		4.50		
		Water Depth	m	1.75	2.05		?		
		Filtered Area	m^2/unit	27.8	13.3		42.8		
		Velocity	$m^3/d/m^2$	94.6 OK	184.8	OK	245.6 High Rate		
		Filter Media							
		E.S. of Sand		Effective Size -	Effective Size -		Standard Size		
		Depth of Sand	mm	650	650.0				
		Type of Underdrain System		Pipe with Slit	Pipe with Slit				
		Year Replacement of Media		1996			No Replacement		
		W. L. of Filter	m				121.00		
		Assessment of Condition		Working	Working		Working		
	Filter Washing Method	Air Scouring Rate	$m^3/min/m^2$	0.00	0.00		0.12 NO		
		Air Scouring Time	min	10	10		10		
		Backwash Rate	$m^3/min/m^2$	0.14 NO	0.2 NO		0.47 OK 600 m3/30 min		
		Backwashing Time	min	Using Back Wash Tank 10	Using Back Wash Tank + Pump ? 10		Using Back Wash Tank 30 ?		
		Frequency of Washing		General Season : each basin - 1 time/day			General Season: 1 Time/72 hrs (2 Beds/Day)		
				Monsoon Season : each basin - 2 times/day			Monsoon Season: 1 Time/48 hrs (2 Beds/Day)		
	Backwash Pump & Motor	Capacity	m^3/min	0.00 Lifting Pump	0.0 Lifting Pump		5.0 Lifting Pump		
			m^3/hr	& Motor	& Motor		299.9 & Motor		
			m^3/d	0	0.0		7,197.1		
		Number	unit	1 1	2				
		Stand-by	unit						
		Total Capacity	m^3/min	0.00	0.00		0.0		
			m^3/d	0	0.0		0.0		
		Head	m						
		Type of Pump		Centrifugal	Centrifugal		Centrifugal		
		Motor Output	HP	7.5 5.0	50.0		24.8		
			kW				18.5		
		Assessment of Condition		Working	Working		Working		

Table M31.5.2 Present Conditions of Sanquelim Water Treatment Plant (6/9)

Name of Facility			Contents of Facility					Remarks
			Sanquelim W.T.P.			Podocem W.T.P.	TOTAL	
			(1) 5 MLD	(2) 7 MLD	Total	(3) 40 MLD		
	Air Blower	Capacity	0.0	0.0		2.5		
		m^3/min				150.0		
		m^3/hr						
		m^3/d	0	0.0		3,600		
		Number	unit	2	2		2	
		Stand-by	unit	1	1		1	
		Total Capacity	m^3/min	0.0	0.0		2.5	
			m^3/d	0	0.0		3,600.0	
		Head						
		Motor Output	HP	15.0	20.0		40.2	
			kW	11.0			30.0	
		Assessment of Condition	Working		Working		Working	
	Clear Water Collection Reservoir	Number of C.W.R.	Unit				M.B.R.	
		Diameter	m	16.0	18.0		40.0	
		Water Depth	m	4.0	4.0		4.0	
		Number	Unit	1	1		2	
		Volume	m^3	800	1,000		5,000	
		Total	m^3	800	1,000	1,800	10,000	
		Detention Time	hr	3.8	3.4	#DIV/0!	4.6	
		Last Date of Cleaning		Pediodical	Pediodical		Pediodical	
		Water Level	m				117.00	
							113.00	
		Assessment of Condition		Good	Good		Good	
	Dirty Water Sump	Number	Unit	-	-	-	-	
		Diameter	m	-	-	-	13.00	
		Water Depth	m	-	-	-	1.50	
		Volume	m^3/unit	-	-	-	199.1	
		Retention Time	min	-	-	-		
		Water Level	m	-	-	-	117.50	
				-	-	-	116.00	
		Assessment of Condition		-	-	-	Working	

Table M31.5.2 Present Conditions of Sanquelim Water Treatment Plant (7/9)

Name of Facility			Contents of Facility					Remarks
			Sanquelim W.T.P.			Podocem W.T.P.	TOTAL	
			(1) 5 MLD	(2) 7 MLD	Total	(3) 40 MLD		
Chemical Facility								
Alum Feeding Facility	Capacity	kg/hr						
		m^3/unit	2.0	2.0				
	Width	m						
	Length	m						
	Height	m						
	Volume	m^3	0.0	0.0		12.50 w/ Poly-Electrolite Solution Tank 8 m^3		
	Number	Unit	3	3		3		
	Stand-by		1	1				
	Assessment of Condition		Working	Working		Working		
Lime Feeding Facility	Capacity	kg/hr						
		m^3/unit	2.0	2.0				
	Diameter	m						
	Width	m						
	Length	m						
	Height	m						
	Volume	m^3				8.00 w/ Poly-Electrolite Solution Tank 8 m^3		
	Number	Unit	3	3		3		
	Stand-by		1	1				
	Assessment of Condition		Working	Working		Working		
Disinfection System	Chemical Used		Liquid Chlorine/Bleaching Powder	Liquid Chlorine/Bleaching Powder		Liquid Chlorine		
	Type of Plant & Machinery		Chlorinator	Chlorinator		w / Booster Pump 6m^3/hr×50m Head		
	Capacity	kg/hr	2.5	2.5		10.0		
	Number	Unit	2	2		3		
	Stand-by							
	Safty Measures Taken		Neutralization Tank(Caustic Soda)			-		
	Commissioned		1994	1994		2003		
	Assessment of Condition		Working	Working		Working		

Table M31.5.2 Present Conditions of Sanquelim Water Treatment Plant (8/9)

Name of Facility		Contents of Facility						Remarks
		Sanquelim W.T.P.			Podocem W.T.P.		TOTAL	
		(1) 5 MLD	(2) 7 MLD	Total	(3) 40 MLD			
Laboratory								
Chemical Testing Laboratory		Nil	Nil		Commissioned			
Jar Testing		Nil	Nil		Nil			
Availability of Skilled Chemists		Nil	Nil		-			
Availability of Required Chemicals		Alum & Lime	Alum & Lime		Alum & Lime			
		From Assonara Store	From Assonara Store		From Assonara Store			
Use of Test Reports		Check Quality of Filter/Tre	Check Quality of Filter/Treatment		As per Format			
Frequency of Sampling		Hourly (pH, R-Cl)			Hourly (pH, Turb., R-Cl, D.O.)			
Frequency of Sampling & Analysis		Monthly : Other (Turb., pH, Alkalinity, Hardness, Chloride, Mn, Fe, D.O., Fe, R.-Cl)Test			20 Parameter Tests Fortnightly			
General Quality of Water		Good	Good		Treatable Water Treatment Process			
Raw Water Quality		Turbid., Low pH	Turbid., Low pH		Turbid., Low pH			
Clear Water Quality		Good(0.8NTU)	Good(0.8NTU)		Good			
Transformers								
Number/Name of Transformer		Raw Water Intake	Sanquelim WTP					
Pole Mounted / Pad Mounted		Pole	Pole		Pad			
Capacity	kVA	200	200		200			
Number	Unit	2	1		1			
Commissioned		1994	1994		2003			
Likely Design Life	Year	20	20		30			
Last Replacement		-	-		-			
Stand-by		-	-		-			
Assessment of Condition		Good	Good		Good			
Equipment Status								
Flow Meters		-	-		Ultrasonic			
Other Operating Valves		-	-		Working			
Other Important Assets								
Valve's Condition		Working	Working		Working			
Visible Leakage and Locations		Nil	Nil		Nil			
Building Condition					Good			
Wastewater Disposal Arrangements		Discharge in Nala through Sludge Chamber			Recycling w/Pumping Arrangement			

Present Condition of Sanquelim / Podocem Water Treatment Plant

No.3

Organization & Staff Deployed

		2 Plants (5 MLD & 7 MLD)	Plant of 40 MLD
General Shift			
	Working Hour :	08:30 am → 05:30 pm	
		Junior Engineer 1 Persons	
		Electriciann 1 Person	
		Helper 5 Persons	
		Total 7 Persons	Total 0 Persons
Shift in Plant Operation		2 Plants (5 MLD & 7 MLD)	Plant of 40 MLD
	Shifting System	3 Shifting System Covering 24 Hours	
	Working Hour :	①: 08:00 am → 02:00 pm, ②: 02:00 pm → 08:00 pm, ③: 08:00 pm → 08:00 am	
	Grouping Staff Deployed :	Raw Water Intake: 2 Persons/Each Shift	Raw Water Intake: 2 Persons/Shift × 3 Groups
		W.T.P. : 2 Persons/Each Shift	W.T.P. : 8 Persons/Shift × 3 Groups
			Additional Staff : 4 Persons
			Shift in Charge : 2 Persons

Staff Deployed at the Plant		2 Plants (5 MLD & 7 MLD)				Plant of 40 MLD			
		Person	Qualification	Year of Service	Service at plant	Person	Qualification	Year of Service	Service at plant
Management Staff - Engineers									
	Assistant Engineer					1	D.C.E.	26	1
	Technical Assistant					1	B.E.	20	1
	Junior Engineer	1	D.E.E.	23	16				
	Sub-total	1				2			
Skilled Staff - Operators / Quality Testing									
	Supervisor	-	-	-	-	2	SSLC		
	Chemist	-	-	-	-	3	BSC(Chem)		
	Chlorine Operator	-	-	-	-	3	XIIth Science		
	Filter Operator	1				-	-	-	-
	Pump Operator	2				9	I.T.I.		
	Electrician	1	I.T.I.			3	I.T.I. (Elec)		
	Mechanics G-Ⅱ	3	I.T.I.			3	I.T.I. (Mech)		
	Work Assistant	2				-	-	-	-
	Operator	4				-	-	-	-
	Assistant Operator	2				-	-	-	-
	Plumber	1				-	-	-	-
	Sub-total	16				23			
Unskilled Staff		4	- Workman 1, Labour 2, Sweeper 1			13	Helper-10, Sweeper-2, Gardener-1		
Total Number		21				38			

Table M31.5.3 Monthly Water Quality of Sanquelim Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

	Color			Odor			Taste			Turbidity (NTU)			pH			Specific Conductivity (/u mhos/cm)			Total Solids (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0.0	0.0		Unobjectable			Unobjectable			8.9	2.7		7.2	7.8		53.0	57.3		37.0	38.0	
Feb-03	0.0	0.0		Unobjectable			Unobjectable			5.3	1.2		7.0	7.1		54.9	66.3		36.0	42.0	
Mar-03	0.0	0.0		Unobjectable			Unobjectable			5.2	1.4		6.6	7.1		55.1	61.1		37.0	39.0	
Apr-03	0.0	0.0		Unobjectable			Unobjectable			7.0	1.8		6.3	6.9		51.9	55.9		34.0	36.0	
May-03	0.0	0.0		Unobjectable			Unobjectable			2.2	0.5		6.5	6.8		64.1	69.9		44.0	45.0	
Jun-03	0.0	0.0		Unobjectable			Unobjectable			7.5	1.5		6.3	7.2		68.5	80.5		46.5	52.0	
Jul-03	0.0	0.0		Unobjectable			Unobjectable			7.8	2.2		6.2	7.4		43.8	72.4		31.0	46.0	
Aug-03	0.0	0.0		Unobjectable			Unobjectable			7.8	2.4		6.7	7.4		39.1	50.3		27.5	32.0	
Sep-03	0.0	0.0		Unobjectable			Unobjectable			5.7	2.8		6.8	7.2		43.0	56.5		30.0	36.5	
Oct-03	0.0	0.0		Unobjectable			Unobjectable			7.4	1.1		7.0	7.4		50.2	59.6		34.5	38.0	
Nov-03	0.0	0.0	0.0	Unobjectable			Unobjectable			11.2	2.0	2.0	6.6	7.3	7.3	58.7	76.0	76.6	41.5	49.0	49.0
Dec-03	0.0	0.0	0.0	Unobjectable			Unobjectable			3.8	0.6	0.6	6.8	7.0	7.0	59.3	77.0	77.2	39.5	49.0	49.0
Jan-04				Unobjectable			Unobjectable														
Feb-04	0.0	0.0	0.0	Unobjectable			Unobjectable			5.2	2.0	2.1	6.9	7.2	7.2	58.1	65.2	65.4	38.5	42.0	42.0
Mar-04	0.0	0.0	0.0	Unobjectable			Unobjectable			4.1	1.1	1.1	6.8	7.1	7.0	62.3	61.8	61.2	41.0	39.0	39.0
Apr-04	0.0	0.0	0.0	Unobjectable			Unobjectable			4.2	0.9	1.0	6.7	6.9	7.0	62.7	62.9	61.8	41.0	40.0	40.0
May-04	0.0	0.0	0.0	Unobjectable			Unobjectable			2.9	0.6	0.5	6.7	7.2	7.2	65.8	88.4	88.1	42.5	56.5	56.0
Jun-04	0.0	0.0	0.0	Unobjectable			Unobjectable			24.2	6.4	7.4	6.5	8.0	8.0	48.7	96.2	97.3	39.0	63.5	64.0
Jul-04	0.0	0.0	0.0	Unobjectable			Unobjectable			23.2	2.9	2.5	7.1	8.2	7.2	43.0	61.7	61.2	34.0	39.5	39.0
Aug-04	0.0	0.0	0.0	Unobjectable			Unobjectable			32.2	4.9	2.4	7.1	7.2	7.2	43.7	46.3	46.5	37.0	31.0	29.0
Sep-04	0.0	0.0	0.0	Unobjectable			Unobjectable			12.0	2.4	2.0	7.3	7.4	7.5	52.9	54.6	54.8	37.5	35.0	35.0
Oct-04	0.0	0.0	0.0	Unobjectable			Unobjectable			1.0	1.0	1.0	7.0	7.3	7.3	56.0	63.4	63.5	39.0	40.5	40.5
Nov-04	0.0	0.0	0.0	Unobjectable			Unobjectable			4.1	2.0	2.0	6.8	7.0	7.0	72.2	76.1	78.8	47.0	50.0	51.0
Dec-04				Unobjectable			Unobjectable														
Jan-05	0.0	0.0	0.0	Unobjectable			Unobjectable			9.1	1.5	1.8	6.7	7.1	7.2	49.7	51.2	51.3	35.0	33.0	33.0
Feb-05	0.0	0.0	0.0	Unobjectable			Unobjectable			5.7	2.3	1.9	6.5	6.6	6.8	59.8	60.1	64.0	40.0	38.0	40.0
Mar-05	0.0	0.0	0.0	Unobjectable			Unobjectable			3.9	2.0	2.0	6.9	7.0	7.0	59.4	64.1	65.3	39.0	41.0	41.0
Apr-05	0.0	0.0	0.0	Unobjectable			Unobjectable			4.6	1.9	2.0	6.6	6.8	7.0	60.6	61.5	61.8	40.5	39.0	39.0
May-05	0.0	0.0	0.0	Unobjectable			Unobjectable			4.8	2.0	2.2	6.7	7.4	8.2	69.5	71.0	70.5	45.5	45.0	45.0
Max	0.0	0.0	0.0							32.2	6.4	7.4	7.3	8.2	8.2	72.2	96.2	97.3	47.0	63.5	64.0
Min	0.0	0.0	0.0	Unobjectable			Unobjectable			1.0	0.5	0.5	6.2	6.6	6.8	39.1	46.3	46.5	27.5	31.0	29.0
Average	0.0	0.0	0.0							8.2	2.0	2.0	6.8	7.2	7.2	55.8	65.5	67.4	38.3	42.1	43.0

	Total Dissolved Solids(TDS) (mg/L)			Suspended Solids (mg/L)			Total Hardness as $CaCO_3$ (TA (mg/L)			Ca^{2+} (mg/L)			Mg^{2+} (mg/L)			Cl^- (mg/L)			Total Alkalinity as $CaCO_3$ (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	35.0	38.0		2.0	0.0		18.0	21.0		4.0	6.0		2.0	1.5		6.0	6.0		18.0	22.0	
Feb-03	34.0	42.0		2.0	0.0		10.0	28.0		4.8	8.4		1.8	1.8		6.0	6.0		14.0	15.0	
Mar-03	35.0	39.0		2.0	0.0		20.0	23.0		5.2	6.4		1.8	1.8		6.0	6.0		20.0	24.0	
Apr-03	32.0	36.0		2.0	0.0		17.0	20.0		4.4	5.6		1.5	1.5		6.0	6.0		23.0	27.0	
May-03	43.0			2.0	0.0		22.0	25.0		4.4	6.0		2.8	2.5		8.0	8.0		23.0	27.0	
Jun-03	44.0	52.0		2.5	0.0		23.0	33.0		4.8	8.8		2.8	2.8		6.0	6.0		22.0	28.0	
Jul-03	28.0	46.0		3.0	0.0		19.0	33.0		3.6	9.2		2.5	2.5		4.0	4.0		20.0	28.0	
Aug-03	25.0	32.0		2.5	0.0		16.0	24.0		3.6	6.4		1.8	2.0		6.0	6.0		12.0	18.0	
Sep-03	28.0	36.0		2.0	0.5		21.0	25.0		4.0	6.0		2.8	2.5		4.0	22.0		18.0	0.0	
Oct-03	32.0	38.0		2.5	0.0		21.0	26.0		4.0	6.0		2.8	2.8		6.0	6.0		23.0	28.0	
Nov-03	38.0	49.0	49.0	3.5	0.0	0.0	25.0	32.0	32.0	6.0	8.8	8.8	2.5	2.5	2.5	6.0	6.0	6.0	26.0	33.0	33.0
Dec-03	38.0	49.0	49.0	1.5	0.0	0.0	18.0	26.0	26.0	5.6	6.8	6.8	1.0	2.3	2.3	6.0	8.0	8.0	22.0	24.0	24.0
Jan-04																					
Feb-04	37.0	42.0	42.0	1.5	0.0	0.0	13.0	20.0	20.0	4.8	5.2	5.2	1.5	1.8	1.8	8.0	8.0	8.0	21.0	24.0	24.0
Mar-04	39.5	39.0	39.0	1.5	0.0	0.0	20.0	20.0	20.0	5.2	5.2	5.2	1.8	1.8	1.8	6.0	7.0	7.0	25.0	25.0	25.0
Apr-04	40.0	40.0	40.0	1.0	0.0	0.0	19.0	19.0	19.0	4.3	4.8	4.8	1.8	1.8	1.8	6.0	6.0	6.0	24.0	24.0	25.0
May-04	42.0	56.5	56.0	0.5	0.0	0.0	22.0	34.0	34.0	5.6	9.2	9.2	2.0	2.8	2.8	7.0	12.0	12.0	27.0	30.0	30.0
Jun-04	31.0	61.5	62.0	8.0	2.0	2.0	15.0	43.0	43.0	3.6	12.8	12.8	1.5	2.8	2.8	7.0	10.0	10.0	14.0	46.0	46.0
Jul-04	27.5	39.0	39.0	6.5	0.5	0.0	13.0	23.0	23.0	3.2	6.0	6.0	1.3	2.0	2.0	6.0	9.0	9.0	14.0	25.0	25.0
Aug-04	28.0	29.5	29.0	9.0	1.5	0.0	15.0	18.0	18.0	3.6	4.4	4.4	1.5	1.8	1.8	6.0	6.0	6.0	18.0	19.0	19.0
Sep-04	34.0	35.0	35.0	3.5	0.0	0.0	16.0	18.0	18.0	4.0	4.8	4.8	1.5	1.5	1.5	6.0	6.0	6.0	19.0	22.0	22.0
Oct-04	36.0	40.5	40.5	3.0	0.0	0.0	19.0	24.0	24.0	5.6	6.4	6.4	1.3	2.0	2.0	6.0	6.0	6.0	22.0	26.0	26.0
Nov-04	46.0	50.0	51.0	1.0	0.0	0.0	23.0	30.0	30.0	6.0	7.6	7.6	2.5	2.8	2.8	7.0	9.0	9.0	29.0	32.0	32.0
Dec-04																					
Jan-05	32.0	33.0	33.0	3.0	0.0	0.0	14.0	15.0	15.0	4.0	4.4	4.4	1.0	1.0	1.0	6.0	6.0	6.0	20.0	22.0	22.0
Feb-05	38.0	38.0	40.0	2.0	0.0	0.0	20.0	20.0	20.0	4.8	4.8	4.8	2.0	2.0	2.0	7.0	7.0	7.0	21.0	21.0	21.0
Mar-05	38.0	41.0	41.0	1.0	0.0	0.0	18.0	29.0	29.0	4.4	8.4	8.4	1.8	1.8	1.8	8.0	10.0	10.0	20.0	26.0	26.0
Apr-05	39.0	39.0	39.0	1.5	0.0	0.0	22.0	22.0	22.0	4.8	4.8	4.8	2.0	2.0	2.0	8.0	8.0	8.0	23.0	23.0	23.0
May-05	44.0	45.0	45.0	1.5	0.0	0.0	24.0	24.0	24.0	6.0	6.0	6.0	2.3	2.3	2.3	7.0	7.0	7.0	24.0	24.0	24.0
Max	46.0	61.5	62.0	9.0	2.0	2.0	25.0	43.0	43.0	6.0	12.8	12.8	2.8	2.8	2.8	8.0	22.0	12.0	29.0	46.0	46.0
Min	25.0	29.5	29.0	0.5	0.0	0.0	10.0	15.0	15.0	3.2	4.4	4.4	1.0	1.0	1.0	4.0	4.0	6.0	12.0	0.0	19.0
Average	35.7	41.8	42.9	2.7	0.2	0.1	18.6	25.0	24.5	4.6	6.6	6.5	1.9	2.1	2.0	6.3	7.7	7.7	20.8	24.6	26.3

Table M31.5.3 Monthly Water Quality of Sanquelim Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

	SO_4^- (mg/L)			Fe^{2+} (mg/L)			Mn^{2+} (mg/L)			NO_3^{2-} (mg/L)			$KMnO_4$ oxidizability as O_2 (mg/L)			BOD at 27°C and 3days (mg/L)			DO (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0.0	0.0		0.64	0.10		0.00	0.00		0.6	0.0		0.3	0.0		0.5	0.0				
Feb-03	0.0	0.0		0.76	0.05		0.00	0.00		0.7	0.0		0.3	0.0		0.8	0.0				
Mar-03	0.0	0.0		1.00	0.06		0.00	0.00		0.8	0.0		0.3	0.0			0.0				
Apr-03	0.0	0.0		0.00	0.10		0.00	0.00		0.4	0.0		0.2	0.0		0.5	0.0				
May-03	0.0	0.0		0.30	0.05		0.00	0.00		0.5	0.0		0.3	0.0		0.6	0.0				
Jun-03	0.0	4.0		0.76	0.05		0.00	0.00		0.6	0.4		0.4	0.2		0.8	0.5				
Jul-03	0.0	0.0		0.75	0.60		0.00	0.00		0.6	0.0		0.3	0.0		0.8	0.0				
Aug-03	0.0	0.0		1.00	0.05		0.00	0.00		0.8	0.0		0.4	0.0		1.2	0.0				
Sep-03	0.0	0.1		1.15	0.00		0.00	0.00		0.8	0.0		0.4	0.2		1.0	0.0				
Oct-03	0.0	0.0		0.80	0.05		0.00	0.00		0.8	0.0		0.4	0.0		0.9	0.0				
Nov-03	0.0	0.0	0.0	1.50	0.20	0.20	0.00	0.00	0.00	1.2	0.4	0.0	0.6	0.2	0.0	1.5	0.5	0.0	7.2	7.4	7.4
Dec-03	0.0	0.0	0.0	0.64	0.06	0.06	0.00	0.00	0.00	0.8	0.0	0.0	0.3	0.0	0.0	1.0	0.0	0.0	7.4	7.5	7.5
Jan-04																					
Feb-04	0.0	0.0	0.0	0.50	0.10	0.10	0.00	0.00	0.00	0.8	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.1	7.4	7.5
Mar-04	0.0	0.0	0.0	0.45	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	6.9	7.4	7.4
Apr-04	0.0	0.0	0.0	0.45	0.60	0.60	0.00	0.00	0.00	0.6	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	6.9	7.3	7.4
May-04	0.0	0.0	0.0	0.35	0.05	0.05	0.00	0.00	0.00	0.4	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	6.9	7.2	7.3
Jun-04	0.0	0.0	0.0	3.90	0.30	0.30	0.00	0.00	0.00	1.6	0.0	0.0	1.0	0.2	0.0	2.4	0.5	0.0	6.5	6.9	7.1
Jul-04	0.0	0.0	0.0	1.50	0.30	0.10	0.00	0.00	0.00	1.8	0.0	0.0	0.9	0.2	0.0	2.0	0.5	0.0	7.0	7.2	7.2
Aug-04	0.0	0.0	0.0	1.80	0.30	0.20	0.00	0.00	0.00	1.8	0.1	0.0	0.9	0.2	0.0	2.0	0.5	0.0	7.3	7.3	7.4
Sep-04	0.0	0.0	0.0	0.65	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.1	7.4	7.4
Oct-04	0.0	0.0	0.0	0.50	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.1	7.3	7.3
Nov-04	0.0	0.0	0.0	0.40	0.15	0.15	0.00	0.00	0.00	0.3	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.1	7.2	7.3
Dec-04																					
Jan-05	0.0	0.0	0.0	0.60	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.8	0.0	0.0	1.5	0.0	0.0	7.3	7.4	7.5
Feb-05	0.0	0.0	0.0	0.40	0.10	0.10	0.00	0.00	0.00	1.2	0.0	0.0	0.8	0.0	0.0	1.5	0.0	0.0	7.3	7.4	7.4
Mar-05	0.0	0.0	0.0	0.30	0.10	0.10	0.00	0.00	0.00	0.5	0.0	0.0	0.3	0.0	0.0	0.8	0.0	0.0	7.5	7.7	7.7
Apr-05	0.0	0.0	0.0	0.25	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.6	7.6	7.7
May-05	0.0	0.0	0.0	0.25	1.00	0.10	0.00	0.00	0.00	0.7	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	6.9	7.4	7.4
Max	0.0	4.0	0.0	3.90	1.00	0.60	0.00	0.00	0.00	1.8	0.4	0.0	1.0	0.2	0.0	2.4	0.5	0.0	7.6	7.7	7.7
Min	0.0	0.0	0.0	0.00	0.00	0.05	0.00	0.00	0.00	0.3	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	6.5	6.9	7.1
Average	0.0	0.2	0.0	0.80	0.18	0.15	0.00	0.00	0.00	0.8	0.0	0.0	0.4	0.0	0.0	1.0	0.1	0.0	7.1	7.4	7.4

	F^- (mg/L)			Al^{3+} (mg/L)			Plate Count on nutrient agar no/100mL			MPN of Coliform no/100mL			MPN of E.Coli. no/100mL		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0.0	0.0			0.00		168	54	4	2,400	1,100	0	210	150	0
Feb-03	0.0	0.0		0.00	0.00		312	36	1	2,400	240	0	460	95	0
Mar-03		0.0			0.00		288	195	0	4,600	2,400	0	1,100	93	0
Apr-03	0.0	0.0					25	12	0	2,400	1,100	0	150	93	0
May-03	0.0	0.0			0.00		128	39	3	1,100	39	0	240	43	0
Jun-03	0.0	0.0			0.00		590	130	0	4,600	2,400	0	1,100	460	0
Jul-03	0.0	0.0			0.45		380	270	2	4,600	460	0	1,100	240	0
Aug-03	0.0	0.0			0.20		328	81	2	4,600	460	0	1,100	150	0
Sep-03	0.0	0.0			0.20		153	62	2	2,400	1,100	0	1,100	240	0
Oct-03	0.0	0.0			0.04		140	48	3	1,100	1,100	0	460	240	0
Nov-03	0.0	0.0	0.0		0.06	0.06	224	72	3	2,400	1,100	0	240	210	0
Dec-03	0.0	0.0	0.0		0.01	0.01	112	36	0	1,100	240	0	240	43	0
Jan-04															
Feb-04	0.0	0.0	0.0	0.00	0.00	0.00	129	72	2	460	460	0	240	93	0
Mar-04	0.0	0.0	0.0	0.00	0.00	0.00	188	78	4	2,400	1,100	0	1,100	460	0
Apr-04	0.0	0.0	0.0	0.00	0.00	0.00	217	40	1	2,400	93	0	1,100	230	0
May-04	0.0	0.0	0.0	0.00	0.00	0.00	190	75	2	2,400	460	0	1,200	93	0
Jun-04	0.0	0.0	0.0	0.00	0.40	0.40	186	82	2	2,400	1,100	0	210	93	0
Jul-04	0.0	0.0	0.0	0.00	0.08	0.08	172	90	1	4,600	460	0	2,100	93	0
Aug-04	0.0	0.0	0.0	0.00	0.01	0.01	390	102	0	4,600	1,100	0	2,400	460	0
Sep-04	0.0	0.0	0.0		0.01	0.01	190	90	2	1,100	460	0	460	240	0
Oct-04	0.0	0.0	0.0	0.00	0.04	0.04	108	49	0	1,100	460	0	240	210	0
Nov-04	0.0	0.0	0.0	0.00	0.01	0.01	178	54	2	2,400	240	0	1,100	210	0
Dec-04															
Jan-05	0.0	0.0	0.0	0.00	0.01	0.01	145	42	4	2,400	240	0	1,100	93	0
Feb-05	0.0	0.0	0.0	0.00	0.00	0.00	177	132	1	2,400	1,100	0	400	210	0
Mar-05	0.0	0.0	0.0	0.00	0.00	0.00	92	39	1	460	33	0	460	9	0
Apr-05	0.0	0.0	0.0	0.00	0.00	0.00	87	49	4	1,100	460	0	240	93	0
May-05	0.0	0.0	0.0	0.00	0.00	0.00	128	72	3	1,100	240	0	93	93	
Max	0.0	0.0	0.0	0.00	0.45	0.40	590	270	4	4,600	2,400	0	2,400	460	0
Min	0.0	0.0	0.0	0.00	0.00	0.00	25	12	0	460	33	0	93	9	0
Average	0.0	0.0	0.0	0.00	0.06	0.04	201	78	2	2,408	731	0	739	175	0

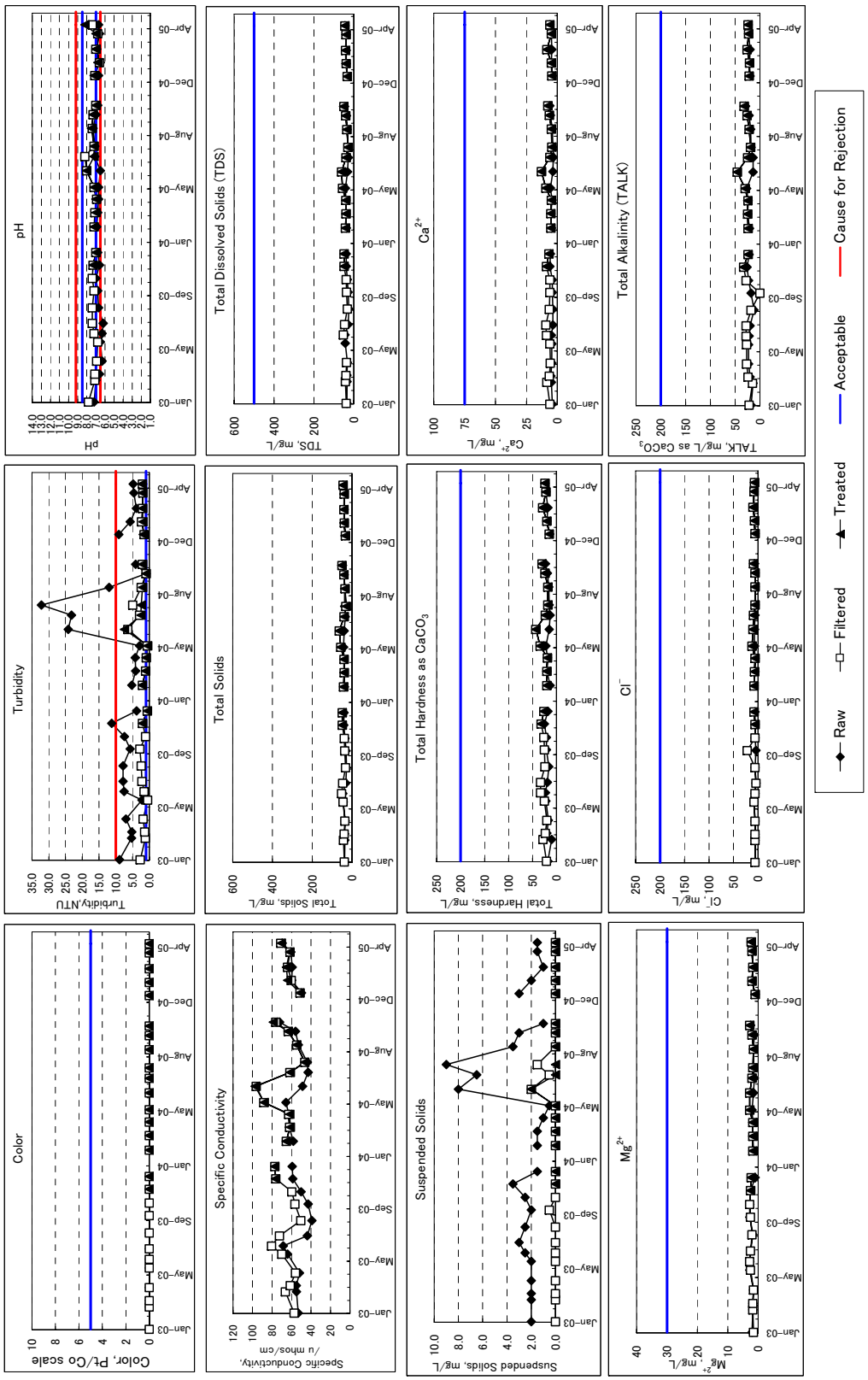

Figure M31.5.2 Monthly Water Quality of Sanquelim Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

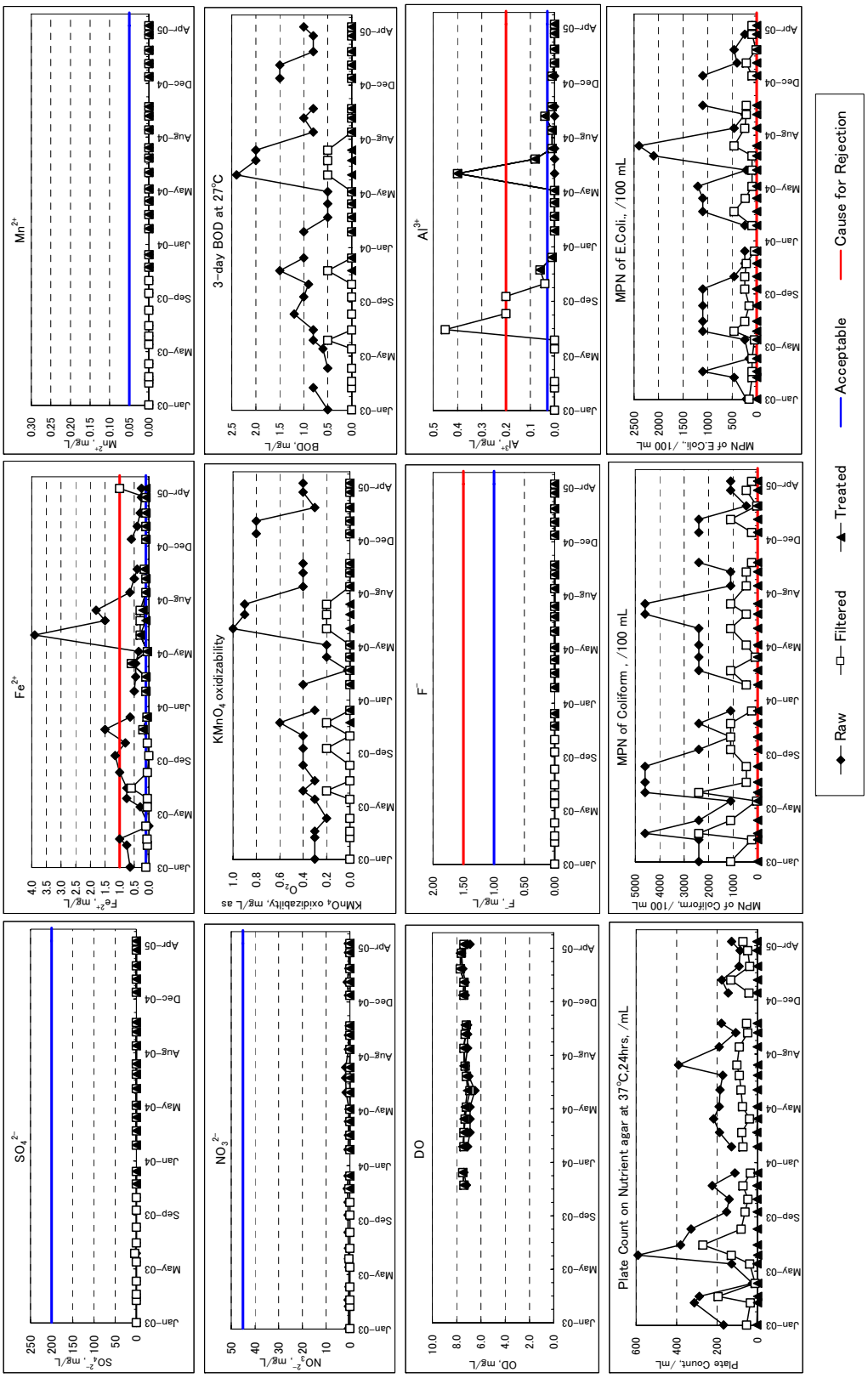

Figure M31.5.2 Monthly Water Quality of Sanquelim Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

Table M31.5.4 Monthly Water Quality of Podosem Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

	Color			Odor			Taste			Turbidity (NTU)			pH			Specific Conductivity (/u mhos/cm)			Total Solids (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03				Unobjectable			Unobjectable														
Feb-03				Unobjectable			Unobjectable														
Mar-03				Unobjectable			Unobjectable														
Apr-03				Unobjectable			Unobjectable														
May-03				Unobjectable			Unobjectable														
Jun-03	0.0	0.0		Unobjectable			Unobjectable			8.9	1.8		7.0			67.3	69.5		46.0	44.0	
Jul-03	0.0	0.0		Unobjectable			Unobjectable			7.1	0.0		6.5			46.4			33.0		
Aug-03	0.0	0.0		Unobjectable			Unobjectable			7.5	0.8		6.7	6.8		48.0	49.9		34.0	32.0	
Sep-03	0.0	0.0		Unobjectable			Unobjectable			8.2	0.0		7.0	7.3		39.6			29.0		
Oct-03	0.0	0.0		Unobjectable			Unobjectable			7.0	1.0		7.0	7.3		49.5	54.8		34.0	35.0	
Nov-03	0.0	0.0	0.0	Unobjectable			Unobjectable			11.5	1.2	1.4	7.1	7.1	7.2	65.4	68.7	69.2	45.0	43.0	43.0
Dec-03	0.0	0.0	0.0	Unobjectable			Unobjectable			4.3	0.0	0.5	7.1		7.1	57.5		62.8	39.0		40.0
Jan-04	0.0	0.0	0.0	Unobjectable			Unobjectable			10.7	0.0	1.8	7.0		7.3	57.5		65.2	40.0		42.0
Feb-04	0.0	0.0	0.0	Unobjectable			Unobjectable			5.1	0.6	0.0	7.1	7.1		57.5	62.0		38.5	40.0	
Mar-04	0.0	0.0	0.0	Unobjectable			Unobjectable			3.5	1.0	1.0	7.1	7.2	7.2	59.4	60.6	58.1	39.0	38.0	38.0
Apr-04	0.0	0.0	0.0	Unobjectable			Unobjectable			4.2	1.2	1.1	7.0	7.3	7.3	59.7	63.4	63.9	39.5	40.5	40.5
May-04	0.0	0.0	0.0	Unobjectable			Unobjectable			5.5	1.1	1.0	7.2	7.3	7.3	62.9	63.1	63.3	42.0	40.0	40.0
Jun-04	0.0	0.0	0.0	Unobjectable			Unobjectable			29.0	1.0	1.2	6.6	6.5	6.9	46.9	50.9	52.5	39.0	32.5	33.5
Jul-04	0.0	0.0	0.0	Unobjectable			Unobjectable			26.0	2.2	0.5	7.2	7.2	7.0	40.8	44.4	45.0	33.0	28.0	28.0
Aug-04	0.0	0.0	0.0	Unobjectable			Unobjectable			24.7	3.2	2.0	7.2	7.2	7.2	43.6	45.5	45.6	35.0	29.5	29.0
Sep-04	0.0	0.0	0.0	Unobjectable			Unobjectable			10.3	1.3	0.4	7.3	7.5	7.5	52.7	53.8	53.7	36.5	34.0	34.0
Oct-04	0.0	0.0	0.0	Unobjectable			Unobjectable			10.0	1.2	1.0	7.1	7.1	7.1	58.0	59.2	59.4	39.5	38.0	38.0
Nov-04	0.0	0.0	0.0	Unobjectable			Unobjectable			4.7	2.0	1.0	7.0	7.3	7.4	68.7	74.5	74.4	45.5	47.5	47.5
Dec-04	0.0	0.0	0.0	Unobjectable			Unobjectable			6.3	1.5	1.5	7.1	7.4	7.5	62.8	63.6	63.7	42.0	41.0	41.0
Jan-05	0.0	0.0	0.0	Unobjectable			Unobjectable			9.7	1.2	1.0	7.0	7.2	7.2	49.0	79.8	48.8	35.0	32.0	32.0
Feb-05	0.0	0.0	0.0	Unobjectable			Unobjectable			6.0	1.4	1.4	6.5	6.7	6.7	57.4	58.9	60.4	39.0	38.0	38.5
Mar-05	0.0	0.0	0.0	Unobjectable			Unobjectable			3.1	1.2	1.2	6.9	7.0	7.1	58.4	60.7	60.3	38.5	39.0	39.0
Apr-05	0.0	0.0	0.0	Unobjectable			Unobjectable			5.2	1.9	1.9	6.8	7.2	7.2	61.9	62.0	65.5	41.0	39.5	42.0
May-05	0.0	0.0	0.0	Unobjectable			Unobjectable			4.8	2.0	2.2	7.0	7.1	8.2	64.6	64.9	64.7	43.0	41.5	41.5
Max	0.0	0.0	0.0							29.0	3.2	2.2	7.3	7.5	8.2	68.7	79.8	74.4	46.0	47.5	47.5
Min	0.0	0.0	0.0	Unobjectable			Unobjectable			3.1	0.0	0.0	6.5	6.5	6.7	39.6	44.4	45.0	29.0	28.0	28.0
Average	0.0	0.0	0.0							9.3	1.2	1.2	7.0	7.1	7.2	55.6	60.5	59.8	38.6	37.7	38.2

	Total Dissolved Solids(TDS) (mg/L)			Suspended Solids (mg/L)			Total Hardness as $CaCO_3$ (TA (mg/L)			Ca^{2+} (mg/L)			Mg^{2+} (mg/L)			Cl^- (mg/L)			Total Alkalinity as $CaCO_3$ (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03																					
Feb-03																					
Mar-03																					
Apr-03																					
May-03																					
Jun-03	43.0	44.0		3.0			23.0	24.0		4.8	5.2		2.8	2.8		6.0	8.0		21.0	19.0	
Jul-03	30.0			3.0			17.0			3.6			2.0			4.0			19.0		
Aug-03	31.0	32.0		3.0			18.0	18.0		4.0	4.0		2.0	2.3		6.0	6.0		10.0	9.0	
Sep-03	26.0			3.0			17.0			3.6			2.0			4.0			19.0		
Oct-03	32.0	35.0		2.0	0.0		20.0	24.0		4.0	5.6		2.5	2.5		6.0	6.0		20.0	20.0	
Nov-03	41.0	43.0	43.0	4.0	0.0	0.0	24.0	25.0	25.0	6.0	6.4	6.4	2.3	2.3	2.3	6.0	8.0		26.0	26.0	26.0
Dec-03	37.0		40.0	2.0		0.0	18.0		18.0	4.4		4.4	1.8		1.8	6.0		6.0	21.0		20.0
Jan-04	37.0		42.0	3.0		0.0	19.0		23.0	4.4		6.0	2.0		2.0	6.0		6.0	23.0		23.0
Feb-04	37.0	40.0		1.5	0.0		20.0	20.0		4.8	4.8		2.0	2.0		6.0	8.0		23.0	23.0	
Mar-04	38.0	38.0	38.0	1.0	0.0	0.0	20.0	23.0	23.0	5.2	6.0	6.0	1.8	2.0	2.0	6.0	7.0	7.0	26.0	27.0	27.0
Apr-04	38.0	40.5	40.5	1.5	0.0	0.0	20.0	20.0	20.0	5.6	5.6	5.6	1.5	1.5	1.5	6.0	6.0	6.0	24.0	24.0	24.0
May-04	40.0	40.0	40.0	2.0	0.0	0.0	20.0	20.0	20.0	4.8	4.8	4.8	2.0	2.0	2.0	7.0	7.0	7.0	24.0	24.0	24.0
Jun-04	30.0	32.5	33.5	9.0	0.0	0.0	11.0	15.0	15.0	2.8	4.0	4.0	1.0	1.3	1.3	7.0	7.0	7.0	12.0	15.0	16.0
Jul-04	26.0	28.0	28.0	7.0	0.0	0.0	12.0	14.0	14.0	2.8	3.6	3.6	1.3	1.3	1.3	6.0	6.0	6.0	14.0	16.0	16.0
Aug-04	28.0	29.0	29.0	7.0	0.5	0.0	15.0	17.0	17.0	3.6	4.0	4.0	1.5	1.8	1.8	6.0	6.0	6.0	17.0	17.0	17.0
Sep-04	33.5	34.0	34.0	3.0	0.0	0.0	18.0	18.0	18.0	4.8	4.8	4.8	1.5	1.5	1.5	7.0	7.0	7.0	20.0	20.0	22.0
Oct-04	37.0	38.0	38.0	2.5	0.0	0.0	19.0	20.0	20.0	4.4	4.8	4.8	2.0	2.0	2.0	6.0	6.0	6.0	21.0	21.0	21.0
Nov-04	44.0	47.5	47.5	1.5	0.0	0.0	24.0	26.0	26.0	5.6	6.4	6.4	2.5	2.5	2.5	7.0	7.0	7.0	25.0	28.0	28.0
Dec-04	40.0	41.0	41.0	2.0	0.0	0.0	20.0	21.0	21.0	4.8	5.2	5.2	2.0	2.0	2.0	7.0	7.0	7.0	23.0	24.0	24.0
Jan-05	32.0	32.0	32.0	3.0	0.0	0.0	14.0	15.0	15.0	4.0	4.4	4.4	1.0	1.0	1.0	7.0	7.0	7.0	19.0	20.0	20.0
Feb-05	37.0	38.0	38.5	2.0	0.0	0.0	18.0	19.0	19.0	4.4	4.8	4.8	1.8	1.8	1.8	7.0	7.0	7.0	20.0	20.0	20.0
Mar-05	37.5	39.0	39.0	1.0	0.0	0.0	18.0	22.0	22.0	4.4	5.6	5.6	1.8	2.0	2.0	8.0	8.0	8.0	20.0	21.0	21.0
Apr-05	39.5	39.5	42.0	1.5	0.0	0.0	20.0	20.0	20.0	4.8	4.8	5.2	2.0	2.0	2.0	8.0	8.0	9.0	22.0	22.0	22.0
May-05	41.5	41.5	41.5	1.5	0.0	0.0	21.0	21.0	21.0	4.8	4.8	4.8	2.3	2.3	2.3	7.0	7.0	7.0	22.0	22.0	22.0
Max	44.0	47.5	47.5	9.0	0.5	0.0	24.0	26.0	26.0	6.0	6.4	6.4	2.8	2.8	2.5	8.0	8.0	9.0	26.0	28.0	28.0
Min	26.0	28.0	28.0	1.0	0.0	0.0	11.0	14.0	14.0	2.8	3.6	3.6	1.0	1.0	1.0	4.0	6.0	6.0	10.0	9.0	16.0
Average	35.7	37.6	38.2	2.9	0.0	0.0	18.6	20.1	19.8	4.4	5.0	5.0	1.9	1.9	1.8	6.3	7.0	6.8	20.5	20.9	21.8

Table M31.5.4 Monthly Water Quality of Podosem Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

	SO_4^- (mg/L)			Fe^{2+} (mg/L)			Mn^{2+} (mg/L)			NO_3^{2-} (mg/L)			$KMnO_4$ oxidizability as O_2 (mg/L)			BOD at 27°C and 3days (mg/L)			DO (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03																					
Feb-03																					
Mar-03																					
Apr-03																					
May-03																					
Jun-03	0.0			0.50	0.06		0.00			0.6			0.4			0.8					
Jul-03	0.0			0.64			0.00			0.8			0.4			1.0					
Aug-03	0.0	0.0		0.80	0.05		0.00	0.00		0.9	0.0		0.4	0.0		1.0	0.0				
Sep-03	0.0			1.30			0.00			1.2			0.4			1.2					
Oct-03	0.0	0.0		0.76	0.05		0.00	0.00		0.6	0.0		0.4	0.0		0.8	0.0				
Nov-03	0.0	0.0	0.0	1.60	0.10	0.10	0.00	0.00	0.00	1.2	0.0	0.0	0.8	0.0	0.0	1.6	0.0	0.0	7.3	7.4	7.5
Dec-03	0.0		0.0	0.75		0.06	0.00		0.00	0.8	0.0		0.4		0.0	1.0		0.0	7.3		7.4
Jan-04	0.0		0.0	0.60		0.05	0.00		0.00	1.2		0.0	0.4		0.0	1.0		0.0	7.1		7.5
Feb-04	0.0	0.0		0.40	0.05		0.00	0.00		0.6	0.0		0.2	0.0		0.5	0.0		7.1	7.5	
Mar-04	0.0	0.0	0.0	0.40	0.06	0.06	0.00	0.00	0.00	0.6	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	6.0	7.3	7.3
Apr-04	0.0	0.0	0.0	0.45	0.06	0.06	0.00	0.00	0.00	0.7	0.0	0.0	0.3	0.0	0.0	0.6	0.0	0.0	6.9	7.2	7.4
May-04	0.0	0.0	0.0	0.60	0.05	0.05	0.00	0.00	0.00	0.8	0.0	0.0	0.4	0.0	0.0	0.9	0.0	0.0	6.9	7.3	7.3
Jun-04	0.0	0.0	0.0	2.60	0.10	0.10	0.00	0.00	0.00	1.8	0.0	0.0	1.2	0.0	0.0	3.0	0.0	0.0	6.5	6.9	7.0
Jul-04	0.0	0.0	0.0	1.40	0.12	0.10	0.00	0.00	0.00	1.9	0.0	0.0	1.0	0.0	0.0	2.1	0.0	0.0	7.0	7.2	7.2
Aug-04	0.0	0.0	0.0	1.40	0.20	0.10	0.00	0.00	0.00	1.5	0.0	0.0	0.8	0.0	0.0	1.6	0.0	0.0	7.1	7.2	7.2
Sep-04	0.0	0.0	0.0	0.50	0.10	0.10	0.00	0.00	0.00	0.5	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.1	7.4	7.4
Oct-04	0.0	0.0	0.0	0.55	0.06	0.06	0.00	0.00	0.00	0.6	0.0	0.0	0.4	0.0	0.0	0.9	0.0	0.0	7.2	7.4	7.4
Nov-04	0.0	0.0	0.0	0.35	0.15	0.15	0.00	0.00	0.00	0.3	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	6.9	7.3	7.3
Dec-04	0.0	0.0	0.0	0.55	0.10	0.10	0.00	0.00	0.00	0.4	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.1	7.3	7.3
Jan-05	0.0	0.0	0.0	0.65	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.8	0.0	0.0	1.0	0.0	0.0	7.2	7.4	7.4
Feb-05	0.0	0.0	0.0	0.50	0.10	0.10	0.00	0.00	0.00	0.5	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.3	7.5	7.5
Mar-05	0.0	0.0	0.0	0.35	0.05	0.05	0.00	0.00	0.00	0.4	0.0	0.0	0.2	0.0	0.0	0.6	0.0	0.0	7.5	7.7	7.7
Apr-05	0.0	0.0	0.0	0.40	0.10	0.10	0.00	0.00	0.00	0.7	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.5	7.6	7.6
May-05	0.0	0.0	0.0	0.40	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.4	0.0	0.0	0.9	0.0	0.0	7.0	7.3	7.3
Max	0.0	0.0	0.0	2.60	0.20	0.15	0.00	0.00	0.00	1.9	0.0	0.0	1.2	0.0	0.0	3.0	0.0	0.0	7.5	7.7	7.7
Min	0.0	0.0	0.0	0.35	0.05	0.05	0.00	0.00	0.00	0.3	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	6.0	6.9	7.0
Average	0.0	0.0	0.0	0.77	0.09	0.09	0.00	0.00	0.00	0.8	0.0	0.0	0.5	0.0	0.0	1.1	0.0	0.0	7.1	7.3	7.4

	F^- (mg/L)			Al^{3+} (mg/L)			Plate Count on nutrient agar no/100mL			MPN of Coliform no/100mL			MPN of E.Coli. no/100mL		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03															
Feb-03															
Mar-03															
Apr-03															
May-03															
Jun-03	0.0	0.0			0.05		524	5	3	4,600	0	0	2,400	0	0
Jul-03	0.0	0.0			0.01		315	5	0	2,400	0	0	1,100	0	0
Aug-03	0.0	0.0					293	68	3	2,400	240	0	460	43	0
Sep-03	0.0	0.0					103	48	0	2,400	460	0	460	240	0
Oct-03	0.0	0.0			0.01		156	51	2	2,400	93	0	460	23	0
Nov-03	0.0	0.0	0.0		0.02	0.02	235	42	4	2,400	93	0	150	23	0
Dec-03	0.0	0.0	0.0			0.02	204	4	2	4,600	0	0	210	0	0
Jan-04	0.0	0.0	0.0			0.00	83	21	1	1,100	93	0	75	0	0
Feb-04	0.0	0.0		0.00	0.00										
Mar-04	0.0	0.0	0.0	0.00	0.00	0.00	179	34	3	2,400	93	0	460	23	0
Apr-04	0.0	0.0	0.0	0.00	0.00	0.00	119	24	3	2,400	43	0	460	23	0
May-04	0.0	0.0	0.0	0.00	0.00	0.00	127	66	1	2,400	460	0	150	93	0
Jun-04	0.0	0.0	0.0	0.00	0.00	0.00	188	34	0	4,600	75	0	2,400	20	0
Jul-04	0.0	0.0	0.0	0.00	0.01	0.01	194	59	0	2,400	240	0	1,100	93	0
Aug-04	0.0	0.0	0.0	0.00	0.01	0.01	308	12	0	4,600	23	0	1,100	0	0
Sep-04	0.0	0.0	0.0	0.00	0.00	0.00	121	5	0	2,400	9	0	460	0	0
Oct-04	0.0	0.1	0.1	0.00	0.08	0.08	223	9	1	2,400	43	0	1,100	15	0
Nov-04	0.0	0.0	0.0	0.00	0.04	0.04	162	16	1	2,400	93	0	210	15	0
Dec-04	0.0	0.0	0.0	0.00	0.02	0.02	102	18	4	1,100	43	0	210	4	0
Jan-05	0.0	0.0	0.0	0.00	0.01	0.01	122	18	0	2,400	43	0	1,100	23	0
Feb-05	0.0	0.0	0.0	0.00	0.00	0.00	162	18	1	2,400	150	0	1,100	4	0
Mar-05	0.0	0.0	0.0	0.00	0.00	0.00	112	12	0	2,400	9	0	210	0	0
Apr-05	0.0	0.0	0.0	0.00	0.00	0.00	93	15	3	2,400	150	0	240	23	0
May-05	0.0	0.0	0.0	0.00	0.04	0.04	120	74	3	2,400	240	0	240	93	0
Max	0.0	0.1	0.1	0.00	0.08	0.08	524	74	4	4,600	460	0	2,400	240	0
Min	0.0	0.0	0.0	0.00	0.00	0.00	83	4	0	1,100	0	0	75	0	0
Average	0.0	0.0	0.0	0.00	0.02	0.01	185	29	2	2,670	117	0	689	33	0

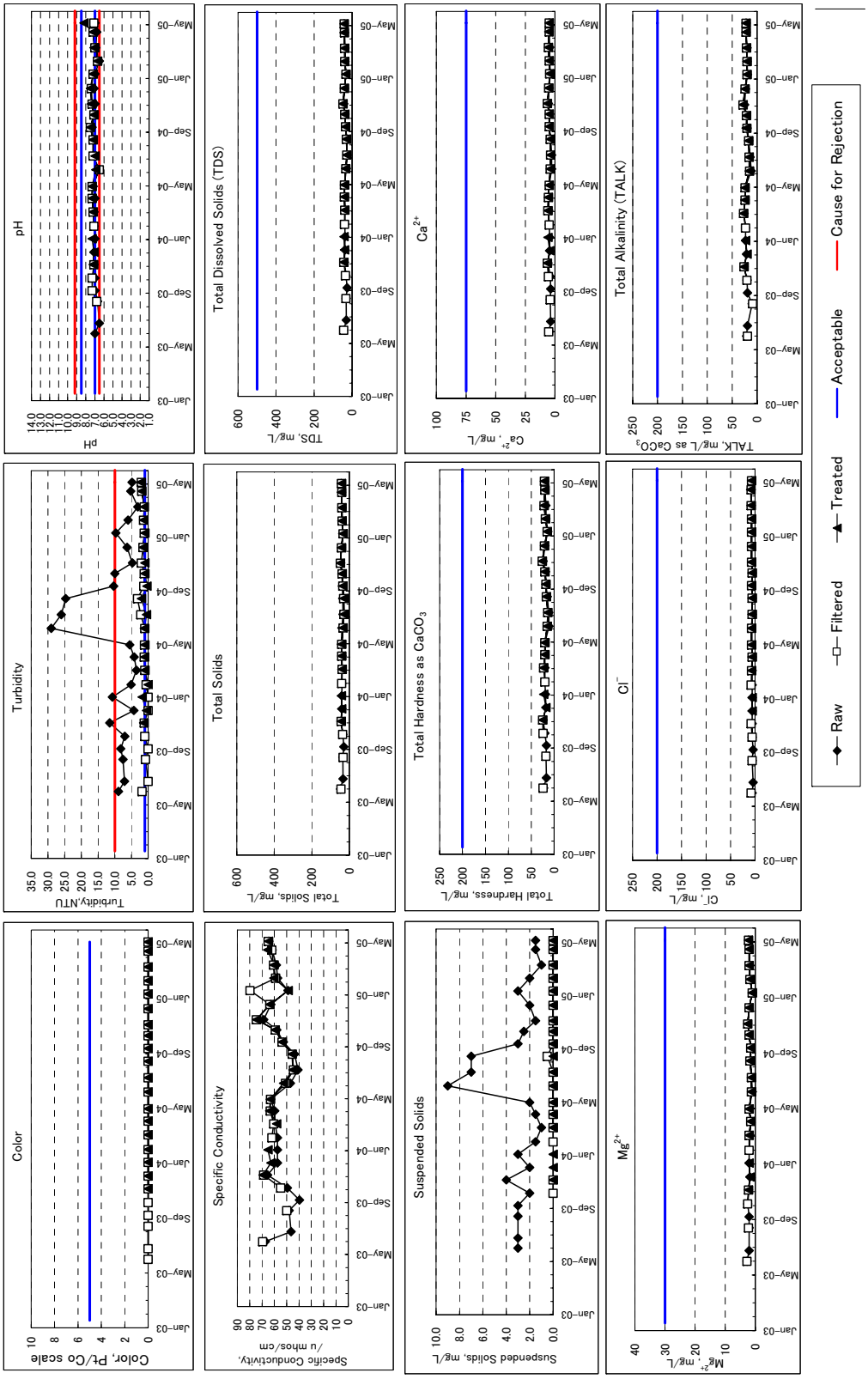

Figure M31.5.3 Monthly Water Quality of Podosem Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

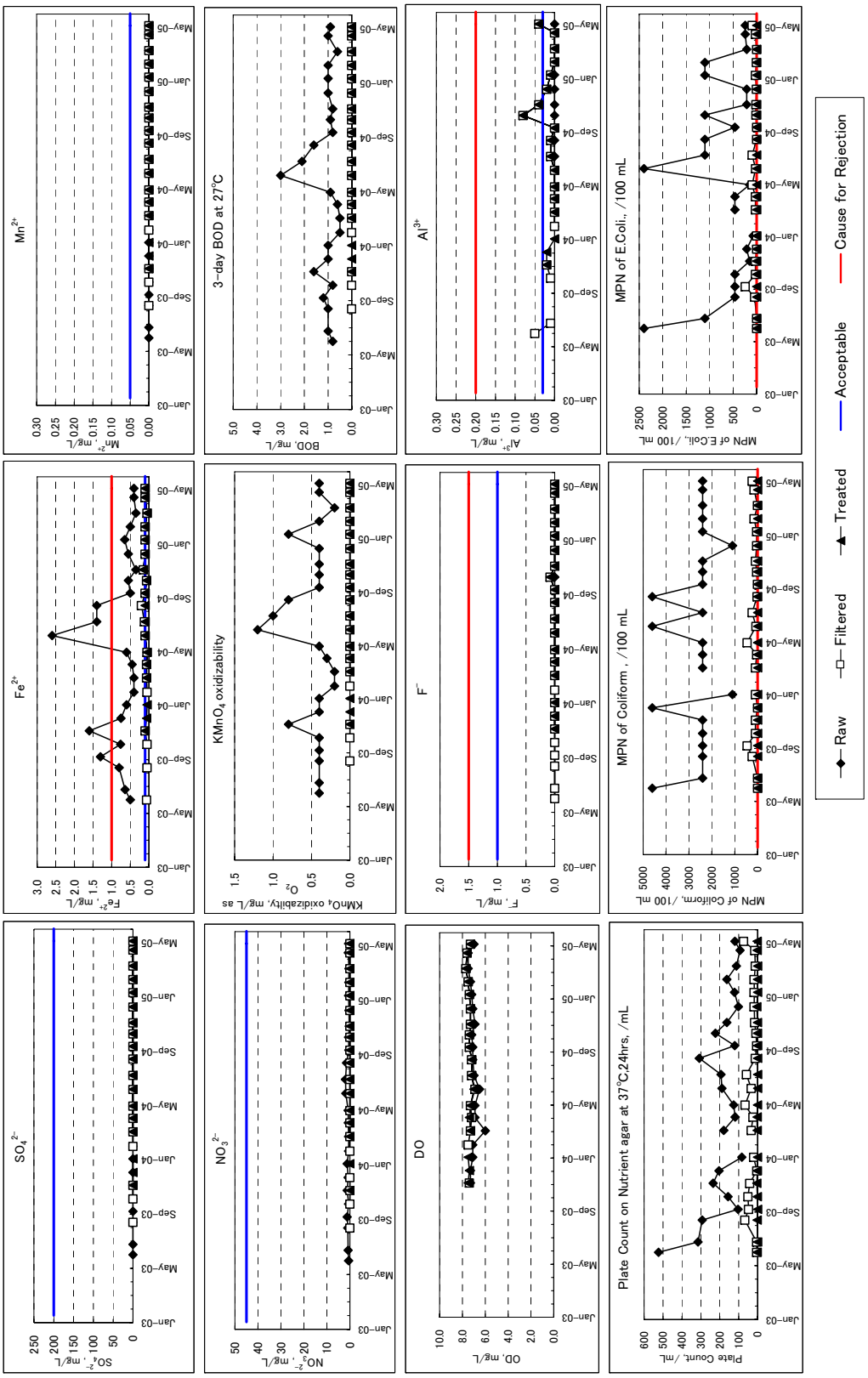

Figure M31.5.3 Monthly Water Quality of Podosem Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

Table M31.5.5 List of Reservoirs for the Sanquelim Water Supply Scheme

Series No.	System	Inlet Pipe		Name of GLR / OHR (Name of Location)	GLR/OHR					Supply Area		Remarks
		Dia. (mm)	Material		Type	Capacity (m3)	Elevation (m) RL	HWL	LWL	Taluka	Village Name	
1	Sanquelim			Sanquelim WTP	MBR	800	56.00					
2					MBR	1,000	56.00					
3		250	ACP	Sanquelim	GLR	300	30.00				Carapur(CT)(24)	w/Pumping Station, Pumping to Series
4		250	ACP		GLR	300	30.00					
5		250	CIP	Sanquelim	GLR	800	95.00			Bicholim	Sanquelim(M CI)(25)	
6		50	CIP	Virdi	GLR	300	65.00			-ditto-	Sanquelim(M CI)(25)	
7		150	ACP	Pariem (?)	OHR	150	68.00			-ditto-	Sanquelim(M CI)(25)	
				Sub-Total		**3,650**						
8	Podocem-1			Podocem WTP	MBR	5,000	113.00	117.00	113.00	-ditto-		
9					MBR	5,000	113.00	117.00	113.00	-ditto-		
10				Curchirem	GLR	100	54.00			Bicholim	Curchirem(10)	
11		350	DIP	Sarvana	GLR	800	62.00			-ditto-	Bicholim(M CI)(23), Sarvona(11)	
12		350	DIP	Bicholim	GLR	800	35.00					w/Pumpimg Station, Pumping to Mayem
13		350	DIP		GLR	150	22.00			Bicholim	Bicholim(M CI)(23)	
14		350	DIP		GLR	300	42.00			-ditto-	Ona(8)	
15		300	CIP	Mayem	GLR	800	84.00			-ditto-	Maem(12), Vainguinim(13), Aturli(14),	
16		300	CIP		GLR	800	84.00			-ditto-	Naroa(15)	
										Tiswadi	Ambarim(1), Chorao(2), Caraim(3), Capao(4)	
17		100	CIP	Piligao	GLR	100	50.00			-ditto-	Piligao(16)	
18		150	DIP	Mulgao	GLR	300	54.00			-ditto-	Milgao(7)	
19					OHR		45.00			-ditto-		
20		100	PVC	Maulinguem North	GLR	50	35.00			-ditto-	Maulinguem North(9)	
21		100	CIP	Ladfem	GLR	50	35.00			-ditto-	Latambarcem(4)	
				Sub-Total		**14,250**						
22	Podocem-2	150	DIP	Navelim	GLR	300	54.00			Bicholim	Navelim(19)	
23		150	DIP	Honda	GLR	300	68.00			Satari	Onda(21)	
24		150	ACP	Pisurlem	GLR	150	61.00			-ditto-	Pissurlem(43)	
25		150	DIP	Dignem	GLR	300	90.00			Bicholim	Cudnem(17)	
26		150	DIP	Amona	GLR	150	70.00			-ditto-	Amone(18)	
27		250	CIP	Surla	GLR	800	87.00			-ditto-	Cotombi(20), Surla(21), Pale(CT)(26)	
28		150	DIP	Velgem	GLR	300	62.00			-ditto-	Velguem(22)	w/Pumping Station
29		200	CIP	Pali	GLR	300	130.00			-ditto-	Pale(CT)(26)	Not in Operation
30		200	CIP		GLR	300	130.00			-ditto-		
				Sub-Total		**2,900**						
	Total					**17,150**						
						11.1						

Note: RL=Reduced Level (Base Elevation of GLR), HWL=High Water Level in Reservoir, LWL=Low Water Level in Reservoir, GLR=Ground Level Reservoir, OHR=Over Head Reservoir, MBR=Master Balancing Reservoir

M31.6 Dabose Water Supply Scheme

The scheme consists of a 5 MLD plant, commissioned around 1992. We are told that the plant is currently running at 7 MLD to help met demand.

The raw water pump house contains two pumps (one duty) and takes water from the Madei River. The pumps are well guarded.

The plant is manually operated. The plant appears to be in good working condition despite its age. There are no flow measuring devices. Security arrangements at the site are good. Maintenance standards are very good, except for at the chemical mixing areas. The chlorine house is equipped with two No. 1 tonne cylinders and one vacuum type chlorinator. There is no standby chlorinator. An immersion tank is available. The chlorination system appears to be well maintained and tidy.

A standby generator is available at the site for use during power failures. Records of pump operating hours, loads, chemical use and treatment parameters are logged.

Table M31.6.1 lists the summary of asset data for the WTP and Table M31.6.2 contains detailed asset data for the WTP. The plant schematic is shown on Figure M31.6.1.

Table M31.6.3 and Figure M31.6.2 show the data on monthly water quality at Dabose Water Treatment Plant. Table M31.6.4 shows a list of existing reservoirs for Dabose Water Supply Scheme.

Table M31.6.1 Summary of Asset Register of Dabose Water Treatment Plant

Name of Facility		Contents of Facility	Remarks
Raw Water Intake & Raw Water Transmission Facility	Jack Well & Connecting Pipe	^{D}6.0 m × ^{H}17.0m D400mm × CIP × 7.0m × 1 Line	Manderi River
	Pump & Motor	Vertical Pump: ^{Q}260m^3/hr×^{H}42m×45kw×2 units (1 – Standby) Submersible Pump: ^{Q}100m^3/hr×^{H}42m×20kw×1 unit	Design Cap. of Intake Pump = 6.5MLD
	Raw Water Transmission Main	D350mm × 300m × CIP ×1 Line	
Treatment Facility	Aerator	Cascade Type: 1 unit	
	Parshal Flume & Flash Mixer	Each 1 unit (for Chemical Dosing)	
	Clariflocculator	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: ^{D}26.0m (Flocc. Zone 3.0m)×^{WD}4.0m×1 unit Detention Period: Flocculation – 7.8min Clarifier – 9.6hrs [1)] Surface Loading for Clarifier: 10 m^3/m^2/d (7.0 mm/min) [2)]	1): 2～2.5 hrs 2): 30～40m^3/m^2/d
	Filter	Gravity Rapid Sand Filter Type ^{W}4.7m × ^{L}5.00m × 2cells/basin × 3 basins Effective Size of Sand:0.??mm, Depth of Sand: 0.??m Filter Area: 11.75 m^2/cell, 23.5 m^2/basin Filtration Rate: 5.0 m/hr [3)] (74.5 m/d) Air Scouring Rate: 22.2 m/hr/cell [4)] (0.37m^3/min/m^2/cell) Backwash Rate: 12 m/hr/cell [5)] (0.20m^3/min/m^2/cell)	Based on Specifications of Air Blower & Backwash Pump 3): 4.8～6.0m/hr 4): 36～54m/hr 5): 24～36m/hr
Clear Water Facility	Clear Water Sump	^{D}11.5m ×× ^{WD}4.0m × 1 unit Total Volume=415 m^3 Retention Time: 2.0 hr	
Chemical Feeding Facility	Alum Feeding Facility	Dry Aluminum Sulfate Solution Tank: 2 units	
	Lime Feeding Facility	Powder Lime Solution Tank: 2 units	
	Disinfection Facility	Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 2 units	
Laboratory	Frequency of Sampling & Analysis	Not In-Service, Jar Test: Not in Service Daily test: pH, R-Cl Fortnightly: 20 Parameters	
Clear Water Transmission Facility	Transmission Pump & Motor	Horizontal Centrifugal Pump: ^{Q}230m^3/hr × ^{H}95m × 110kw × 3 units (1 or 2 – Standby)	Design Cap. of Pump = 11MLD
	Rising Main	D300mm × CIP × 15m × 1 Line D350mm × CIP × 800m × 1 Line	
	Clear Water Reservoir (MBR)	^{D}16.0m ×× ^{WD}4.0m × 1 unit Total Volume=800 m^3	
Note: 1) ～ 4) are referring to "Manual on Water Supply and Treatment, Third Edition – Revised and Updated, May 1999"			

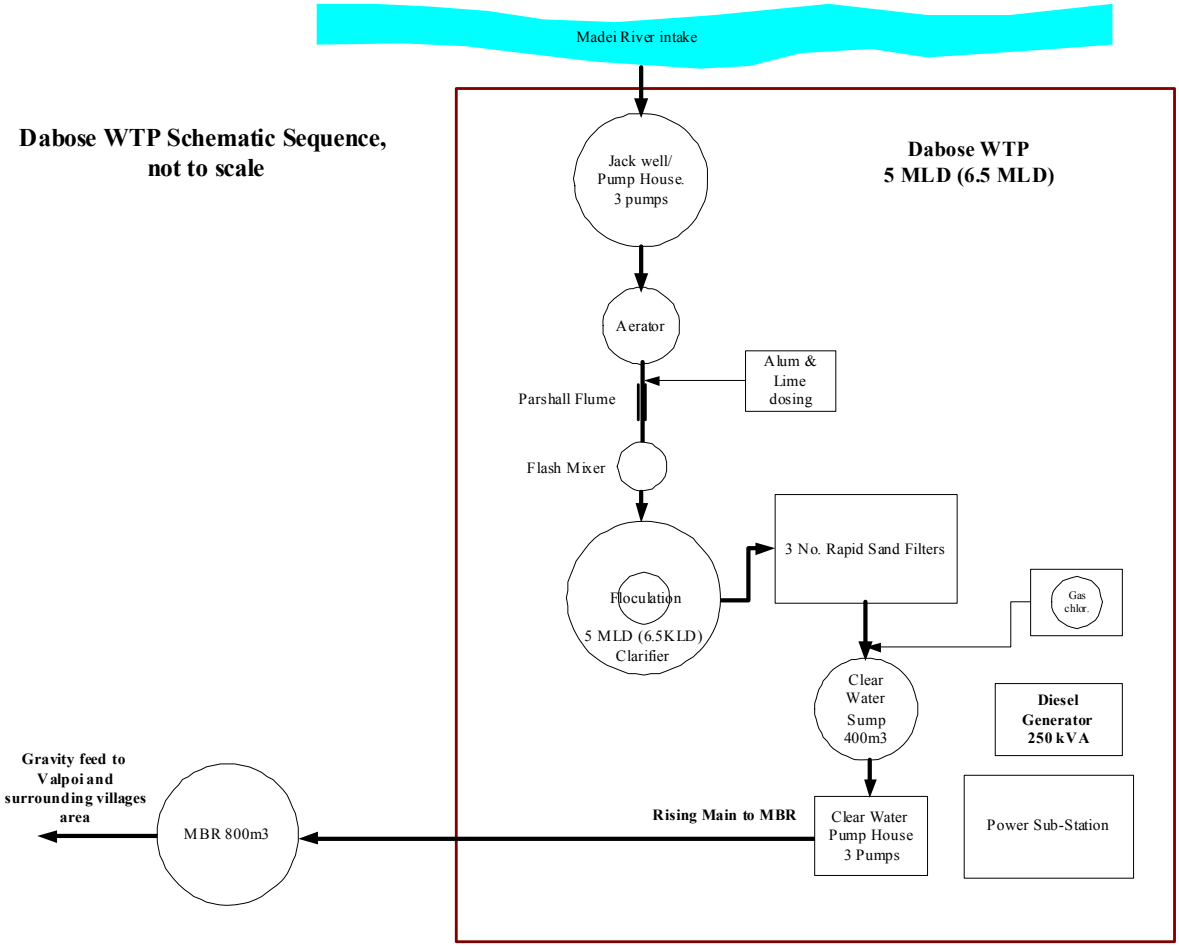

Figure M31.6.1 Schematic Sequence of Dabose Water Treatment Plant

Table M31.6.2 Present Conditions of Dabose Water Treatment Plant (1/6)

Item			Contents	Remarks
Background				
Covered Area for Water Supply		Taluka	Part of Sattari	
Name of Plant				
Number of W.T.P.		Number	(1)	
Capacity of Plant		MLD	5	
		m^3/d	5,000	
Raw Water Resources		River	Madei	
		Dam		
Year of Construction		Year	1990 - 1992	
Year of Commission		Year	1992	
Expected Augmentation Plan			10 MLD	

Table M31.6.2 Present Conditions of Dabose Water Treatment Plant (2/6)

Name of Facility			Contents of Facility		Remarks
Capacity of Raw Water Intake & Water Treatment Plant		MLD	5.25		: 5% Loss of Nominal Capacity
		m^3/d	5,250		
Head Water Works : Raw Water Intake					
Intake Well	Diameter	m	6.00		
	Height	m	8.00		
	Water Depth	m	?		
	Volume	m^3/unit	0.0		
	Water Level of River				
	H.W.L.	m	?		
	L.W.L	m	?		
Connecting Pipe	Diameter	mm	400		C= 110
	Length	m	7.0		D= 0.4
	Material		CIP		Q= 0.0608
	Velocity	m/sec	0.484		
	Loss of Head	m	0.006		: Hazen-Williams Formula
Jack Well & Pump House	Diameter	m	6.00		
	Height	m	17.00		
	Water Depth	m	?		
	Volume	m^3/unit	0		
	Detension Time	min	0.00		
Control Room	Width	m	4.0		
	Length	m	4.0		
	Area of Floor	m^2	16.0		
Raw Water Pump	Capacity	ℓ/sec	72.2	27.8	
		m^3/min	4.33	1.67	
		m^3/hr	260	100	
		m^3/d	6,240	2,400	
	Number	unit	2	1	
	Stand-by	unit	0	1	
	Total Capacity	m^3/d	12,480		Not 24 hrs Running
	Head	m	42.0	42.0	
	Type of Pump		Centrifugal	Submersible	
	Maker		Jyoti (V.T.)		
	Year of Manufacture		1992	1996	
	Assessment of Condition		Working Condition		
Raw Water Motor	Motor Output	HP	60	27	
		kW	45	20	
	Number	Unit	2	1	
	Maker		Kirlosker	-	
	Year of Manufacture		1992	1996	
	Assessment of Condition		Working Condition		
Raw Water Transmission Line	Diameter	mm	350		
	Length	m	300		
	Material		CIP		
	Velocity	m/sec	0.174		
	Loss of Head	m	0.500		: Hazen-Williams Formula
	Assessment of Condition	Pipe	Good		
		Valve	Good		
Water Treatment Plant					
Aerator	Capacity	m^3/hr	218.8	208	: Answer to Questionnare
		m^3/d	5,250	4,992	
	Number	Unit	1		
	Diameter	m	3.65		
	Height	m	?		
	El. of Top Aerator	m	?		
	Assessment of Condition		Working		
Parshal Flume	Number	Unit	1		
	Assessment of Condition		Working		

Table M31.6.2 Present Conditions of Dabose Water Treatment Plant (3/6)

Name of Facility				Contents of Facility	Remarks
	Flash Mixer	Number	Unit	1	
		Assessment of Condition		Working	
	Clarifiers / Settling Tank (Coagulation Basin)	Dsign Capacity	m^3/min/unit	3.6	
			m^3/hr/unit	218.8	
			m^3/d/unit	5,250	
		Number	Unit	1	
		Type of Clarifier		Circulaar Horizontal Flow Type with Center Feed /Peripherical Collection	
		Water Depth	m	4.00	
		Overall Diameter	m	26.00	
		Flocc. Zone Dia.	m	3.00	
		Frequency of Desludging		Once a Day : General Season	
				Twice a Day : Monsoon Season	
		Volume			
		Overall	m^3/unit	2,123.7	
		Flocculation Zone	m^3/unit	28.3	
		Clarifying Zone	m^3/unit	2095.4423	
		Retention Time			
		Flocculation Zone	min	7.8	
		Clarifying Zone	min	574.7 OK	
		Overall	min	582.5	
		Surface Area	m^2/unit	523.9	
		Surface Loading	mm/min	7.0 OK	
		W.L. of Clarifier	m	?	
		Assessment of Condition		Working	
	Flocculator & Drive Arrangement	Number	unit	1	
		Assessment of Condition			
				Working	
	Filter	Design Capacity	m^3/hr/unit	72.9	
			m^3/d/unit	1,750	
		Number	Unit	3	
		Type		Rapid Sand Gravity Filter	
		Width	m	5.00	
		Length	m	4.70	
		Water Depth	m	?	
		Filtered Area	m^2/unit	23.5	
		Velocity	$m^3/d/m^2$	74.5 OK	
		Filter Media		Standard Size	
		E.S. of Sand	mm	?	: E.S. = Effective Size
		Depth of Sand	mm	?	
		Type of Underdrain System		?	
		Year Replacement of Media		Replacement (Year: Jun. '05)	
		W. L. of Filter	m	?	
		Assessment of Condition		Working	
	Filter Washing Criteria & Method	Air Scouring Rate	$m^3/min/m^2$	0.37 NO	
		Air Scouring Time	min	5	
		Backwash Rate	$m^3/min/m^2$	0.2 NO	
		Backwashing Time	min	10	
		Frequency of Washing		General : Once a Day	
				Maximum : Once a Day	

Table M31.6.2 Present Conditions of Dabose Water Treatment Plant (4/6)

Name of Facility				Contents of Facility	Remarks
	Backwash Pump & Motor	Capacity	m^3/min	5.46	
			m^3/hr	327.6	
			m^3/d	7,862	
		Number	unit	2	
		Stand-by	unit	1	
		Total Capacity	m^3/min	5.46	
			m^3/d	7,862.4	
		Head	m	17.0	
		Type of Pump		Centrifugal	
		Motor Output	HP		
			kW	26.0	
		Assessment of Condition		Working	
	Air Blower	Capacity	m^3/min	8.80	
			m^3/hr	528.0	
			m^3/d	12,672	
		Number	unit	2	
		Stand-by	unit	1	
		Total Capacity	m^3/min	8.80	
			m^3/d	12,672	
		Head	mm WG		
		Motor Output	HP		
			kW	9.3	
		Maker			
		Assessment of Condition		Working	
	Clear Water Reservoir (Sump)	Diameter	m	11.50	
		Water Depth	m	4.00	
		Number	Unit	1	
		Volume	m^3	415	
		Total	m^3	415	
		Detention Time	hr	2.0	
		Last Date of Cleaning		Pediodical	
		Water Level	m	?	
				?	
		Assessment of Condition		Working	
Chemical Facility					
	Alum Feeding Facility	Capacity	kg/hr		
			m^3/unit	2.0	
		Diameter	m		
		Width	m		
		Length	m		
		Height	m		
		Volume	m^3		
		Number	Unit	2	
		Stand-by			
		Assessment of Condition		Working	

Table M31.6.2 Present Conditions of Dabose Water Treatment Plant (5/6)

Name of Facility				Contents of Facility			Remarks
Lime Feeding Facility	Capacity	kg/hr					
		m^3/unit		1.0			
	Diameter	m					
	Width	m					
	Length	m					
	Height	m					
	Volume	m^3					
	Number	Unit		2			
	Stand-by						
	Assessment of Condition			Working			
Disinfection System	Chemical Used			Liquid Chlorine			
	Type of Plant & Machinery			Pre & Post			
	Capacity	kg/hr		2.0			
	Number	Unit		2			
	Stand-by						
	Safty Measures Taken			Clynder Emercing Tank			
	Commissioned			1992			
	Assessment of Condition			Working Condition			
Laboratory							
Chemical Testing Laboratory				Not Provided			
Jar Testing				?			
Availability of Skilled Chemists				3 Persons			
Availability of Required Chemicals				From Assonora Store			
							: ? month store
Use of Test Reports				As per Format			
Frequency of Sampling & Analysis				pH & Residual Cl : 3 Times/Day			
				20 Parameters Test : 2 Times/Month			?
General Quality of Water				Treatable with conventional Water Treatment Process			
	Raw Water Quality			Turbid., Low pH			
	Clear Water Quality			Excellent			
Transformers							
Number of Transformer				(1)	(2)	(3)	
Pole Mounted / Pad Mounted				Pole	Pole	Floor	
Capacity		kVA		200	200	630	
Number		Unit		1	1	1	
Stand-by						1	: Diesel Generator: 250 kVA
Commissioned				1992	1992	Old Set	
Likely Design Life		Year		30	30	-	
Last Replacement				Nil	Nil	Nil	
Assessment of Condition				Good	Good	Good	
Equipment Status							
Flow Meters				No Flow Meters			
Other Operating Valves				Working			
Other Important Assets							
Valve's Condition				Working Condition			
Visible Leakage and Locations							
Building Condition				Good			
Wastewater Disposal Arrangements				Sludge Chamber Connected to Nalla			

Table M31.6.2 Present Conditions of Dabose Water Treatment Plant (6/6)

Name of Facility			Contents of Facility			Remarks
Transmission (Clear Water) Facility						
Transmission (Clear Water) Pump	Capacity	ℓ/sec	63.9	63.9		
		m^3/min	3.83	3.83		
		m^3/hr	230.0	230.0		
		m^3/d	5,520	5,520		
	Number	unit	2	1		
	Stand-by		1	1		
	Total Capacity	m^3/d	5,520			
	Head	m	95.0	95.0		
	Type of Pump		Centrifugal Pump			
	Maker		M & Platt			
	Year of Manufacture		1992	Old		
	Assessment of Condition	Pump	Working Condition			
		Valve	Working Condition			
Transmission (Clear Water) Motor	Motor Output	HP	135	135		
		kW	110	110		
	Number	Unit	2	1		
	Maker		Kirlosker			
	Year of Manufacture		1992	Old		
	Assessment of Condition		Working Condition			
Raising Main (Transmission Lines)	Diameter	mm	350	300		
	Length	m	800	15		
	Material		CIP	CIP		
	Velocity	m/sec	0.601	0.819	Total	
	Loss of Head	m	1.217	0.048	1.266	: Hazen-Williams Formula
	Assessment of Condition	Pipe	Working Condition			
		Valve	Working Condition			
Master Balancing Reservoir (M.B.R.)	Diameter	m	16.00			
	Water Depth	m	4.00			
	Number	Unit	1			
	Volume	m^3	804			
	Total	m^3	804			
	Detention Time	hr	3.9			
	Last Date of Cleaning		Pediodical			
	Water Level	m		?		
				?		
	Assessment of Condition		Working Condition			

Organization & Staff Deployed

General Shift	Working Hour :	08:30 → 17:30 (13:00 → 14.00 : Lunch Time)					
	Staff Deployed :	Management Staff - Engineers					
		Manager				1	Person
		Mechanics				1	Person
		Sweeper				2	Persons
		Helper				5	Persons
		Total				9	Persons
Shift in Plant Operation	Shifting System	3 Shifting System Covering 24 Hours					
	Working Hour :	①: 08:00 → 14:00 , ②: 14:00 → 20:00 , ③: 20:00 → 08:00					
	Grouping Staff Deployed :	Manager, Electrician, Lab - Assistant, Operator, Helper & Security		Total 10 Persons/Groupe			
Staff Deployed at the Plant		Person	Qualification	Year of Service	Service at present		
Management Staff - Engineers							
	Assistant Engineer	1	D.C.E.	32	1	PWD's Staff	
	Junior Engineer	1	D.C.E.	15	8		
	Sub-total	2					
Skilled Staff - Operators / Quality Testing							
	Manager	2	Graduate	6	6	Goa PWD	
	Mechanics	1	I.T.I.	12	12	Labour	
	Electrician	3	I.T.I.	12	12	Society's Staff	
	Lab - Assistant	3	I.T.I.	12	12	(Yearly	
	Operator	9	I.T.I.	12	12	Contract	
	Sub-total	18				Basis)	
Unskilled Staff		19 - Helper, Sweeper, Security Guards					
Total Number		39					

Table M31.6.3 Monthly Water Quality of Dabose Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

	Color			Odor			Taste			Turbidity (NTU)			pH			Specific Conductivity (/u mhos/cm)			Total Solids (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	0.0	0.0		Unobjectable			Unobjectable			6.0	1.4		6.8	7.2		77.4	78.0		52.0	51.0	
Feb-03	0.0	0.0		Unobjectable			Unobjectable			2.3	0.5		7.0	7.1		92.2	93.5		60.0	60.0	
Mar-03	0.0	0.0		Unobjectable			Unobjectable			4.6	1.4		6.7	7.0		107.9	113.8		71.0	73.0	
Apr-03	0.0	0.0		Unobjectable			Unobjectable			4.5	0.8		7.0	7.2		108.0	108.9		72.0	71.0	
May-03	0.0	0.0		Unobjectable			Unobjectable			4.9	1.8		6.8	6.9		130.8	137.9		86.0	88.0	
Jun-03	0.0	0.0		Unobjectable			Unobjectable			6.0	1.3		6.8	7.0		84.7	90.3		56.0	58.0	
Jul-03	0.0	0.0		Unobjectable			Unobjectable			35.5	2.4		6.7	7.1		47.6	69.7		42.0	45.0	
Aug-03	0.0	0.0		Unobjectable			Unobjectable			16.2	3.5		6.8	7.1		48.3	52.2		35.0	33.5	
Sep-03	0.0	0.0		Unobjectable			Unobjectable			10.0	1.2		7.2	7.4		52.2	58.2		38.0	38.0	
Oct-03	0.0	0.0	0.0	Unobjectable			Unobjectable			8.1	0.9	0.5	7.3	7.4	7.4	59.1	61.3	61.6	40.0	39.0	39.0
Nov-03	0.0	0.0	0.0	Unobjectable			Unobjectable			4.0	1.6	1.3	7.3	7.4	7.2	75.2	75.3	75.6	50.0	48.0	48.0
Dec-03	0.0	0.0	0.0	Unobjectable			Unobjectable			3.0	1.2	1.2	7.3	7.5	7.5	72.2	74.4	74.3	47.0	47.0	47.0
Jan-04	0.0	0.0	0.0	Unobjectable			Unobjectable			3.5	0.8	0.5	7.2	7.3	7.2	82.7	82.9	82.8	54.0	53.0	53.0
Feb-04	0.0	0.0	0.0	Unobjectable			Unobjectable			1.8	0.2	0.2	7.1	7.3	7.2	91.6	95.5	95.8	58.5	61.0	61.0
Mar-04	0.0	0.0	0.0	Unobjectable			Unobjectable			3.6	0.4	0.4	7.3	7.4	7.1	114.1	116.7	115.8	74.0	74.0	74.0
Apr-04	0.0	0.0	0.0	Unobjectable			Unobjectable			4.0	0.6	0.6	7.2	7.4	7.4	123.8	124.0	124.2	80.5	79.0	79.0
May-04	0.0	0.0	0.0	Unobjectable			Unobjectable			7.4	1.2	1.0	7.2	7.4	7.4	130.8	141.6	141.8	85.0	90.5	90.5
Jun-04	0.0	0.0	0.0	Unobjectable			Unobjectable			72.0	1.9	1.4	6.9	6.9	6.9	48.0	101.2	101.7	55.0	70.0	68.5
Jul-04	0.0	0.0	0.0	Unobjectable			Unobjectable			8.0	2.3	1.5	7.2	7.2	6.0	58.1	58.4	58.0	39.5	37.0	37.0
Aug-04	0.0	0.0	0.0	Unobjectable			Unobjectable			70.7	3.5	2.5	7.4	7.5	7.1	39.3	68.5	75.7	43.5	45.0	48.0
Sep-04	0.0	0.0	0.0	Unobjectable			Unobjectable			9.2	2.3	2.0	7.3	7.5	7.5	54.6	60.1	60.2	38.0	38.0	38.0
Oct-04	0.0	0.0	0.0	Unobjectable			Unobjectable			7.7	1.4	1.2	7.2	7.4	7.4	71.0	73.1	73.4	47.0	46.5	46.5
Nov-04	0.0	0.0	0.0	Unobjectable			Unobjectable			4.4	1.6	1.5	7.3	7.4	7.4	76.5	76.9	76.9	50.0	49.0	49.0
Dec-04	0.0	0.0	0.0	Unobjectable			Unobjectable			2.9	1.3	1.1	7.4	7.5	7.3	80.5	80.6	80.7	52.0	52.0	52.0
Jan-05	0.0	0.0	0.0	Unobjectable			Unobjectable			6.7	1.7	1.5	6.9	7.1	7.0	87.3	89.3	88.8	58.0	57.0	57.0
Feb-05	0.0	0.0	0.0	Unobjectable			Unobjectable			3.9	1.2	1.2	6.8	7.0	7.0	90.7	92.6	92.6	59.0	59.0	59.0
Mar-05	0.0	0.0	0.0	Unobjectable			Unobjectable			5.2	1.7	1.6	6.9	7.1	7.0	110.0	112.0	111.9	72.0	71.5	71.5
Apr-05	0.0	0.0	0.0	Unobjectable			Unobjectable			7.0	1.8	1.8	6.9	7.2	7.2	124.0	130.0	130.0	81.0	83.0	83.0
May-05	0.0	0.0	0.0	Unobjectable			Unobjectable			5.8	1.7	1.8	6.9	7.1	7.1	118.2	119.5	120.0	77.0	76.0	76.0
Max	0.0	0.0	0.0							72.0	3.5	2.5	7.4	7.5	7.5	130.8	141.6	141.8	86.0	90.5	90.5
Min	0.0	0.0	0.0	Unobjectable			Unobjectable			1.8	0.2	0.2	6.7	6.9	6.0	39.3	52.2	58.0	35.0	33.5	37.0
Average	0.0	0.0	0.0							11.3	1.5	1.2	7.1	7.2	7.2	84.7	90.9	92.1	57.7	58.4	58.9

	Total Dissolved Solids(TDS) (mg/L)			Suspended Solids (mg/L)			Total Hardness as $CaCO_3$ (TA (mg/L)			Ca^{2+} (mg/L)			Mg^{2+} (mg/L)			Cl^- (mg/L)			Total Alkalinity as $CaCO_3$ (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03	50.0	51.0		2.0			33.0	34.0		8.8	9.2		2.75	2.75		6.0	6.0		34.0	35.0	
Feb-03	59.0	60.0		1.0			33.0	33.0		10.4	10.4		1.75	1.75		6.0	6.0		17.0	17.0	
Mar-03	69.0	73.0		2.0			48.0	50.0		11.6	12.0		4.75	5.00		6.0	6.0		40.0	48.0	
Apr-03	70.0	71.0		2.0			48.0	48.0		12.8	12.8		4.00	4.00		6.0	6.0		58.0	58.0	
May-03	84.0	88.0		2.0			57.0	59.0		13.6	14.4		5.57	5.75		8.0	8.0		63.0	63.0	
Jun-03	54.0	58.0		2.0			37.0	39.0		8.4	9.2		4.00	6.40		6.0	6.0		35.0	35.0	
Jul-03	31.0	45.0		11.0			18.0	31.0		4.0	8.8		2.00	2.25		20.0	28.0		4.0	4.0	
Aug-03	30.0	33.5		5.0			17.0	17.0		4.4	4.4		1.50	1.50		4.0	4.0		22.0	22.0	
Sep-03	35.0	38.0		3.0			21.0	24.0		4.8	5.6		2.25	2.25		6.0	6.0		23.0	25.0	
Oct-03	38.0	39.0	39.0	2.0			25.0	25.0	25.0	5.6	5.6	5.6	2.75	2.75	2.75	6.0	6.0	6.0	28.0	28.0	28.0
Nov-03	48.0	48.0	48.0	2.0			29.0	29.0	29.0	6.8	6.8	6.8	3.00	3.00	3.00	6.0	6.0	6.0	35.0	33.0	33.0
Dec-03	46.0	47.0	47.0	1.0			32.0	32.0	32.0	8.0	8.0	8.0	3.00	3.00	3.00	6.0	6.0	6.0	35.0	35.0	35.0
Jan-04	52.5	53.0	53.0	1.5			34.0	34.0	34.0	8.0	8.0	8.0	3.50	3.50	3.50	6.0	6.0	6.0	36.0	36.0	36.0
Feb-04	58.5	61.0	61.0	0.0	0.0	0.0	39.0	39.0	39.0	9.6	10.0	10.0	3.50	3.50	3.50	6.0	6.0	6.0	41.0	41.0	41.0
Mar-04	73.0	74.0	74.0	1.0	0.0		48.0	48.0	48.0	11.6	11.6	11.6	4.75	4.75	4.75	6.0	6.0	6.0	55.0	55.0	55.0
Apr-04	79.0	79.0	79.0	1.5	0.0	0.0	52.0	52.0	52.0	8.0	8.0	8.0	5.00	5.00	5.00	6.0	6.0	6.0	58.0	58.0	58.0
May-04	83.0	90.5	90.5	2.0	0.0	0.0	55.0	66.0	66.0	16.0	17.6	17.6	3.75	5.50	5.50	7.0	7.0	7.0	58.0	65.0	66.0
Jun-04	30.5	64.5	65.0	24.5	5.5	3.5	16.0	40.0	40.0	3.6	13.2	13.2	1.75	1.75	1.75	8.0	8.0	8.0	12.0	15.0	15.0
Jul-04	37.0	37.0	37.0	2.5	0.0	0.0	21.0	21.0	21.0	5.2	5.2	5.2	2.00	2.00	2.00	6.0	6.0	6.0	23.0	23.0	23.0
Aug-04	25.5	44.0	48.0	20.0	1.0	0.0	16.0	25.0	25.0	4.0	6.0	6.0	1.50	2.50	2.50	5.0	5.0	5.0	19.0	19.0	19.0
Sep-04	35.0	38.0	38.0	3.0	0.0	0.0	21.0	23.0	23.0	4.8	5.6	5.6	2.25	2.25	2.25	5.0	5.0	5.0	24.0	26.0	26.0
Oct-04	45.0	46.5	46.5	2.0	0.0	0.0	26.0	28.0	28.0	6.0	6.8	6.8	2.75	2.75	2.75	5.0	5.0	5.0	20.0	30.0	30.0
Nov-04	49.0	49.0	49.0	1.0	0.0	0.0	29.0	29.0	29.0	6.8	7.2	7.2	2.75	2.75	2.75	7.0	7.0	7.0	32.0	33.0	33.0
Dec-04	51.5	52.0	52.0	0.5	0.0	0.0	30.0	30.0	30.0	7.6	7.6	7.6	2.75	2.75	2.75	7.0	7.0	7.0	33.0	34.0	34.0
Jan-05	56.0	57.0	57.0	2.0	0.0	0.0	38.0	39.0	39.0	10.4	10.8	10.8	3.00	3.00	3.00	7.0	7.0	7.0	40.0	40.0	40.0
Feb-05	58.0	59.0	59.0	1.0	0.0	0.0	40.0	43.0	43.0	10.8	12.0	12.0	3.25	3.25	3.25	6.0	6.0	6.0	46.0	46.0	46.0
Mar-05	70.0	71.5	71.5	2.0	0.0	0.0	44.0	45.0	45.0	11.6	12.0	12.0	3.75	3.75	3.75	7.0	7.0	7.0	50.0	52.0	52.0
Apr-05	79.0	83.0	83.0	2.0	0.0	0.0	55.0	57.0	57.0	14.4	15.2	15.2	4.75	4.75	4.75	7.0	8.0	8.0	53.0	55.0	55.0
May-05	75.5	76.0	76.0	1.5	0.0	0.0	52.0	52.0	52.0	13.6	13.6	13.6	4.50	4.50	4.50	7.0	7.0	7.0	52.0	49.0	49.0
Max	84.0	90.5	90.5	24.5	5.5	3.5	57.0	66.0	66.0	16.0	17.6	17.6	5.57	6.40	5.50	20.0	28.0	8.0	63.0	65.0	66.0
Min	25.5	33.5	37.0	0.0	0.0	0.0	16.0	17.0	21.0	3.6	4.4	5.2	1.50	1.50	1.75	4.0	4.0	5.0	4.0	4.0	15.0
Average	54.2	58.2	58.7	3.6	0.4	0.2	35.0	37.7	37.9	8.7	9.6	9.5	3.20	3.40	3.35	6.7	7.0	6.4	36.1	37.2	38.7

Table M31.6.3 Monthly Water Quality of Dabose Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

	SO_4^- (mg/L)			Fe^{2+} (mg/L)			Mn^{2+} (mg/L)			NO_3^{2-} (mg/L)			$KMnO_4$ oxidizability as O_2 (mg/L)			BOD at 27°C and 3days (mg/L)			DO (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03				0.64	0.10					0.6				0.3		0.5					
Feb-03				0.56	0.10					0.6			0.2			0.5					
Mar-03				0.70	0.10					0.4			0.2			0.5					
Apr-03				0.40	0.10		0.00			0.4			0.3			0.6					
May-03				0.25	0.06					0.4			0.2			0.5					
Jun-03				0.40	0.10		0.60			0.4			0.8								
Jul-03		0.0		1.20	0.10					0.8			0.8	0.2		1.8					
Aug-03				1.40	0.30					0.7			0.4	0.2		1.0					
Sep-03				0.45	0.10					0.5			0.5			0.9			7.3	7.4	
Oct-03				1.00	0.05	0.05				0.9			0.5			1.2			7.0	7.1	7.1
Nov-03				0.64	0.05	0.05				1.0			0.4			0.8			7.2	7.3	7.5
Dec-03				0.55	0.10					0.8			0.4			1.2			7.5	7.6	7.6
Jan-04				0.30	0.10	0.10				1.2			0.4			1.0			7.1	7.4	7.4
Feb-04	0.0	0.0	0.0	0.30	0.05	0.05	0.00	0.00	0.00	1.0	0.0	0.0	0.3	0.0	0.0	0.8	0.0	0.0	7.1	7.4	7.5
Mar-04	0.0	0.0	0.0	0.25	0.05	0.05	0.00	0.00	0.00	1.0	0.0	0.0	0.3	0.0	0.0	0.6	0.0	0.0	7.0	7.4	7.4
Apr-04	0.0	0.0	0.0	0.30	0.05	0.05	0.00	0.00	0.00	0.9	0.0	0.0	0.3	0.0	0.0	0.8	0.0	0.0	6.8	7.2	7.3
May-04	0.0	0.0	0.0	0.50	0.06	0.06	0.00	0.00	0.00	1.1	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.0	7.2	7.2
Jun-04	0.0	0.0	0.0	3.60	0.60	0.50	0.00	0.00	0.00	2.1	0.8	0.0	1.2	0.4	0.0	2.8	1.0	0.0	6.8	6.9	7.0
Jul-04	0.0	0.0	0.0	0.50	0.20	0.10	0.00	0.00	0.00	0.9	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	6.9	7.1	7.1
Aug-04	0.0	0.0	0.0	4.10	0.30	0.20	0.00	0.00	0.00	3.2	0.3	0.0	1.0	0.2	0.0	2.2	0.5	0.0	7.2	7.3	7.3
Sep-04	0.0	0.0	0.0	0.50	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.3	7.4	7.4
Oct-04	0.0	0.0	0.0	0.60	0.60	0.60	0.00	0.00	0.00	0.5	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.1	7.3	7.3
Nov-04	0.0	0.0	0.0	0.35	0.35	0.35	0.00	0.00	0.00	0.2	0.0	0.0	0.3	0.0	0.0	0.6	0.0	0.0	7.1	7.3	7.3
Dec-04	0.0	0.0	0.0	0.30	0.10	0.10	0.00	0.00	0.00	0.2	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	7.1	7.4	7.4
Jan-05	0.0	0.0	0.0	0.50	0.10	0.10	0.00	0.00	0.00	0.4	0.0	0.0	0.5	0.0	0.0	1.0	0.0	0.0	7.3	7.5	7.5
Feb-05	0.0	0.0	0.0	0.25	0.10	0.10	0.00	0.00	0.00	0.0	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	7.3	7.4	7.4
Mar-05	0.0	0.0	0.0	0.50	0.08	0.08	0.00	0.00	0.00	0.7	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.5	7.7	7.7
Apr-05	0.0	0.0	0.0	0.60	0.10	0.10	0.00	0.00	0.00	0.8	0.0	0.0	0.6	0.0	0.0	1.3	0.0	0.0	7.5	7.6	7.6
May-05	0.0	0.0	0.0	0.25	0.05	0.05	0.00	0.00	0.00	0.8	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.0	7.3	7.3
Max	0.0	0.0	0.0	4.10	0.60	0.60	0.60	0.00	0.00	3.2	0.8	0.0	1.2	0.4	0.0	2.8	1.0	0.0	7.5	7.7	7.7
Min	0.0	0.0	0.0	0.25	0.05	0.05	0.00	0.00	0.00	0.0	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	6.8	6.9	7.0
Average	0.0	0.0	0.0	0.75	0.15	0.15	0.03	0.00	0.00	0.8	0.1	0.0	0.4	0.1	0.0	1.0	0.1	0.0	7.1	7.3	7.4

	F^- (mg/L)			Al^{3+} (mg/L)			Plate Count on nutrient agar no/100mL			MPN of Coliform no/100mL			MPN of E.Coli. no/100mL		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03							146	48	2	460	240		240	43	
Feb-03							510	125	3	1,100	43		460	23	
Mar-03							306	86	1	2,400	1,100		1,100	210	
Apr-03							296	47	6	1,100	75		210	15	
May-03							218	93	4	460	43		150	15	
Jun-03							320	189	28	4,600	1,100		2,400	240	
Jul-03					0.52		170	51	12	1,100	93		240	23	
Aug-03					0.26		184	44	2	2,400	460		1,100	93	
Sep-03					0.03		210	93	2	2,400	460		460	210	
Oct-03					0.02		225	72	4	2,400	240		1,100	21	
Nov-03				0.02	0.02	0.00	158	39	1	1,100	240		1,100	21	
Dec-03					0.01	0.01	136	43	4	2,400	1,100		210	150	
Jan-04					0.00	0.00	144	38	1	2,400	240		2,460	43	
Feb-04	0.0	0.0	0.0	0.00	0.00	0.00	137	22	1	2,400	460	0	240	75	0
Mar-04	0.0	0.0	0.0	0.00	0.00	0.00	117	42	0	1,100	240	0	240	93	0
Apr-04	0.0	0.0	0.0	0.00	0.00	0.00	188	72	3	1,100	240	0	240	43	0
May-04	0.0	0.0	0.0	0.00	0.00	0.00	205	35	2	2,400	240	0	1,100	21	0
Jun-04	0.0	0.0	0.0	0.00	0.18	0.18	205	61	1	2,400	460	0	750	240	0
Jul-04	0.0	0.0	0.0	0.00	0.04	0.04	230	71	3	4,600	460	0	1,500	240	0
Aug-04	0.0	0.0	0.0	0.00	0.12	0.12	350	118	0	4,600	1,100	0	1,100	210	0
Sep-04	0.0	0.0	0.0	0.00	0.05	0.05	118	45	2	2,400	1,100	0	1,100	240	0
Oct-04	0.0	0.0	0.0	0.00	0.04	0.04	206	63	0	2,400	1,100	0	2,400	1,100	0
Nov-04	0.0	0.0	0.0	0.00	0.01	0.01	160	120	4	2,400	460	0	460	0	0
Dec-04	0.0	0.0	0.0	0.00	0.00	0.00	124	15	4	1,100	240	0	460	21	0
Jan-05	0.0	0.0	0.0	0.00	0.00	0.00	163	29	1	2,400	240	0	43	23	0
Feb-05	0.0	0.0	0.0	0.00	0.00	0.00	176	92	0	2,400	460	0	120	23	0
Mar-05	0.0	0.0	0.0	0.00	0.00	0.00	149	48	0	1,100	460	0	93	43	0
Apr-05	0.0	0.0	0.0	0.00	0.00	0.00	82	27	3	150	23	0	93	0	0
May-05	0.0	0.0	0.0	0.00	0.00	0.00	58	17	2	460	240	0	28	21	0
Max	0.0	0.0	0.0	0.02	0.52	0.18	510	189	28	4,600	1,100	0	2,460	1,100	0
Min	0.0	0.0	0.0	0.00	0.00	0.00	58	15	0	150	23	0	28	0	0
Average	0.0	0.0	0.0	0.00	0.06	0.02	196	64	3	1,991	447	0	731	121	0

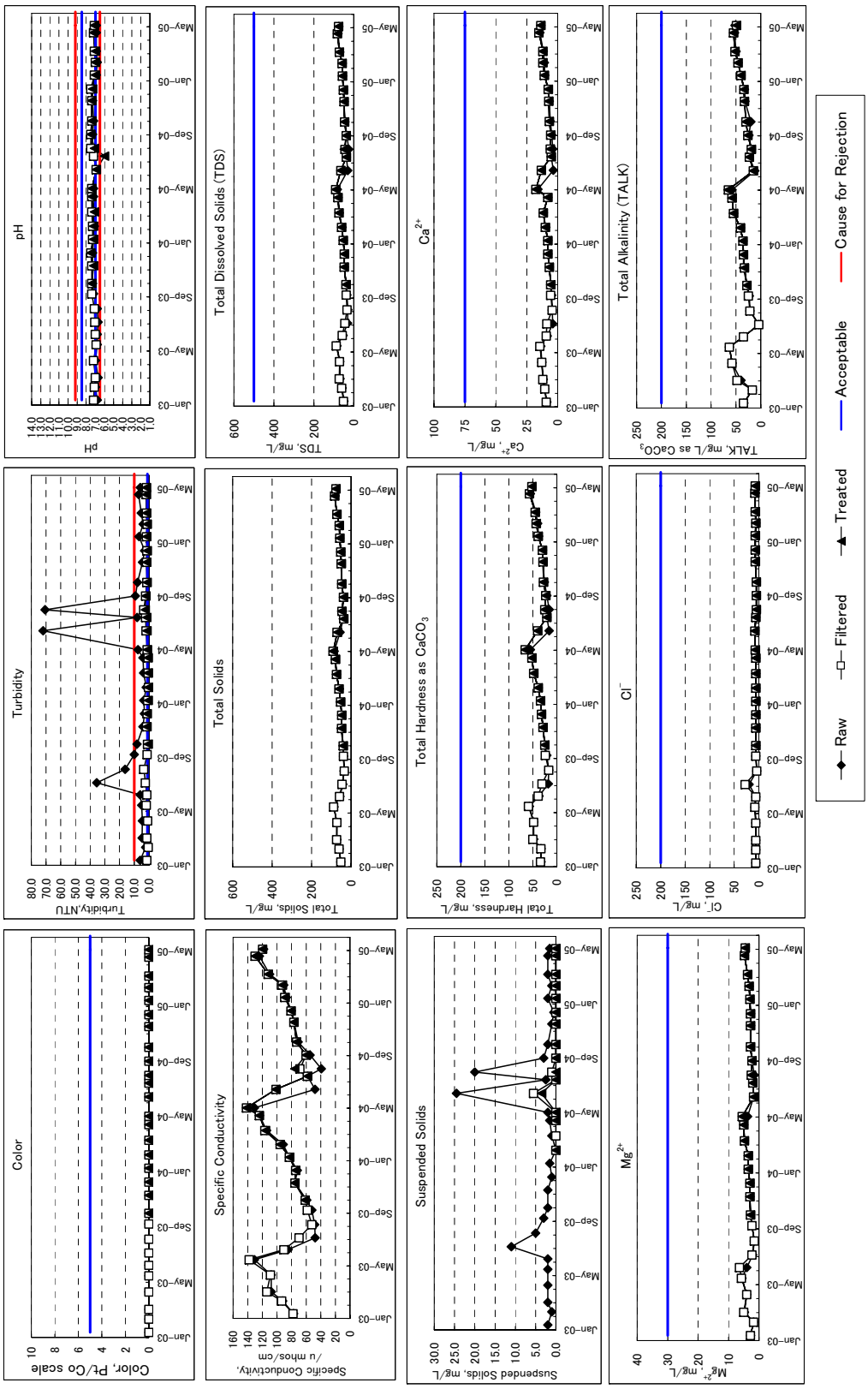

Figure M31.6.2 Monthly Water Quality of Dabose Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

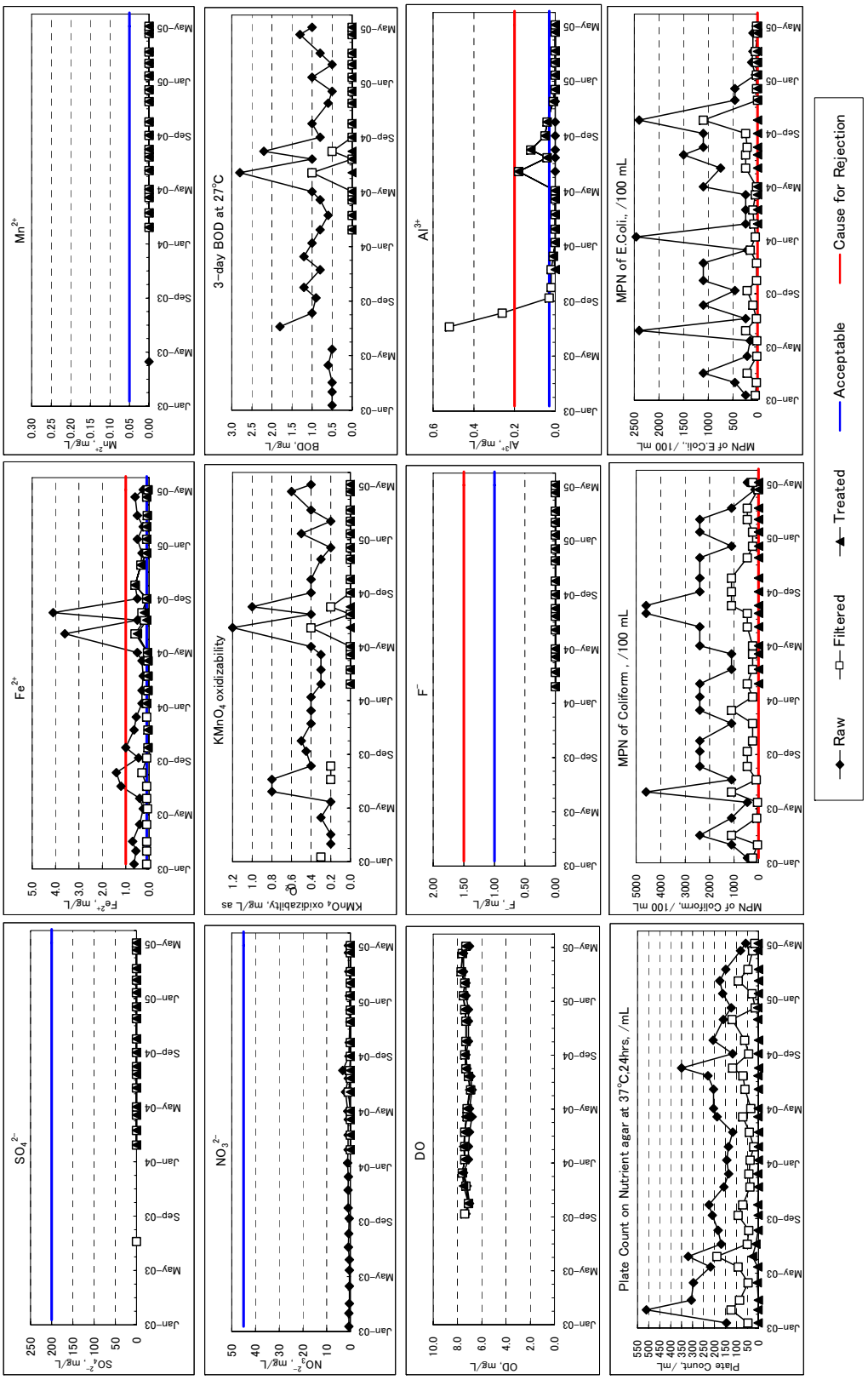

Figure M31.6.2 Monthly Water Quality of Dabose Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

Table M31.6.4 List of Reservoirs for the Dabose Water Supply Scheme

Series No.	Inlet Pipe		Name of GLR / OHR (Name of Location)	GLR/OHR				Supply Area (Village Name)	Remarks
	Dia. (mm)	Material		Type	Capacity (m3)	Elevation (m)			
						RL	HWL	LWL	
1			Dabose WTP	GLR	400	40.00	44.00	40.00	Comporidem(25), Edorem(26), Satorem(39), Mauzi(40), Codiem(46), Naguem(47), Ansolem(48), Codqui(56), Sanvoreem(57)	
2	350	CIP	Dabose MBR	GLR	800	120.00	124.00	120.00		
3	100	ACP	Kudshe	GLR	300	60.00	64.00	60.00	Cudeem(49), Sanvordem(50), Sonal(51), Veguem(55)	w/ Pumping Station
4	150	DIP		GLR	300	120.00	124.00	120.00		
5	100	ACP	Nagargao	GLR	150	60.00	64.00	60.00	Bombedem(36), Ambedem(37), Nagargao(38)	w/ Pumping Station
6	100	DIP		GLR	150	130.00	134.00	130.00		
7	100	PVC	Dabe	GLR	300	60.00	64.00	60.00	Zormen(23), Dabem(24), Mauzi(40)	w/ Pumping Station
8	100	DIP			150	120.00	124.00	120.00		
9	100	DIP	Zarme	GLR	50	85.00	89.00	85.00		w/ Pumping Station
10	100	DIP		GLR	50	160.00	164.00	160.00		
11	150	ACP	Pali	GLR	300	60.00	64.00	60.00	Choraundem(7), Ivrem-Buzruco(8), Ivrem-Curdo(9), Rivem(15), Dongurli(16), Pale(17)	w/ Pumping Station
12	150	DIP		GLR	300	160.00	164.00	160.00		
13	150	ACP	Hivre	GLR	150	60.00	64.00	60.00		w/ Pumping Station
14	100	DIP		GLR	150	105.00	109.00	105.00		
15	350	CIP	Vapoi Town	GLR	800	90.00	94.00	90.00	Valpoi(M Cl)(75)	
16	100	ACP	Cottorem	GLR	300	60.00	64.00	60.00	Guleili(61), Damocem(64), Cotorem(65), COnquirem(74)	w/ Pumping Station
17	150	DIP		GLR	300	130.00	134.00	130.00		
18	150	ACP	Padeli	GLR	300	60.00	64.00	60.00	Advoi(58), Vantem(60), Padeli(62), Birondem(63)	w/ Pumping Station
19	100	DIP		GLR	300	115.00	119.00	115.00		
20	200	ACP	Bhuipal	GLR	300	70.00	74.00	70.00	Saleli(22), Buimpal(41)	w/ Pumping Station
21	200	DIP		GLR	800	135.00	139.00	135.00		
22	100	ACP	Morley Colony	GLR	150	60.00	64.00	60.00	Ponsuli(6), Gululem(18)	w/ Pumping Station
23	100	ACP		OHR	100					
24	100	ACP	Davem	GLR	150	65.00	69.00	65.00	Satrem(12), Derodem(13), Codel(14), Mololi(31)	w/ Pumping Station
25	150	DIP		GLR	150	220.00	224.00	220.00	Monorem(32), Vainguinim(33), Ustem(34), Davem(35)	(2 step pumping)
26	-	-	Kalambolim BK	GLR	150	55.00	59.00	55.00	Carambolim-Brama(28)	
	Total				**7,350**					
					27.1 hrs					

Note: RL=Reduced Level (Elevation of Basement of Reservoir), HWL=High Water Level in Reservoir, LWL=Low Water Level in Reservoir, GLR=Ground Level Reservoir, OHR=Over Head Reservoir, MBR=Master Balancing Reservoir

M31.7 Canacona Water Supply Scheme

The Canacona facility consists of a 5 MLD plant commissioned in 1983. Raw water is sourced from the Tapona River as well as the Chapoli Dam which came into operation in 1997. The river intake has a jack well with 3 pumps (this was locked at the time of visit and therefore we could not assess the condition). The Dam intake pump house was equipped with 3 number 100HP pumps and a small submersible pump (not adequately guarded). The rising main to the plant is approximately 8.5km long.

Table M31.7.1 lists the summary of asset data for the WTP and Table M31.7.2 contains detailed asset data for the WTP. The plant schematic is shown on Figure M31.7.1.

The raw water pump house and treatment plant are situated in separate compounds. Both compounds were adequately gated, fenced and secured by 24 hour on-site security personnel. The plant is manually operated. The plants operate 24 hours a day, using a three shift system.

Measurement of water supplied to and leaving the plant does not occur.

The pump house for the dam raw water intake has three pumps (one duty). Each pump has a capacity of 100HP. A small submersible pump is used to augment supplies rather than operating a second large pump. Site maintenance is good, except that the drive couplings/shafts are not guarded.

Apart from regular oiling and greasing, maintenance tends to be reactive. No operation and maintenance manuals are available and training for new staff is only provided on the job by existing experienced staff. There are no written or formal safety systems for plant operation.

The treatment plant is manually operated. Most equipment appears to be in good working order with the exception of the flash mixer and the clarifier. These two items were not working at the time of the visit. Generally, site maintenance is good. A record of run hours, loads, etc is maintained. Maintenance records are not logged.

The plant has a small on-site laboratory and a log is kept of the usual treatment parameters as well as chemical usage.

Disinfection is achieved using gas chlorination. Bleaching powder is added manually as a

back-up. The chlorination facilities are not fully contained. Chlorination is achieved using one tonne cylinders. There are usually two cylinders in the chlorination facilities at any one time. There is one vacuum type chlorinator (no standby). Chlorinator maintenance is performed in-house, however the chlorinators are not periodically calibrated and maintenance records are not kept. Spare parts for the chlorination facilities are not kept on-site. Chlorination maintenance, installation methods and operation practices are poor. The only facility to detect or contain gas leaks is an immersion tank. The immersion tank was empty at the time of the site visit. Flexible rubber hose (not copper tubing) is used to connect the cylinders to the chlorinator. This is not a safe practice. A poor quality flexible plastic hose was used as the feeder pipe to the contact tanks. The hose was unprotected. This is not a safe practice and should be rectified immediately. Gas masks are provided (canister type). However, in general, there was a poor understanding and awareness of the safety issues associated with the chlorination process.

Table M31.7.3 and Figure M31.7.2 show the data on monthly water quality at Canacona Water Treatment Plant. Table M31.7.4 shows a list of existing reservoirs for Canacona Water Supply Scheme.

Table M31.7.1 Summary of Asset Register of Canacona Water Treatment Plant

Name of Facility		Contents of Facility	Remarks
Raw Water Intake & Raw Water Transmission Facility	Jack Well & Raw water Sump	Jack Well: ^{D}12.0 m × ^{H}3.5m × 1 unit	Talapona River
		Raw Water Sump: Volume= 400m^3	Chapoli Dam
	Pump & Motor	Jack Well - Vertical Pump: ^{Q}180m^3/hr × ^{H}87.0m × 75kw × 3units (2 – Under Installation),	Design Cap. of Intake Pump = 8.8MLD
		Raw Water Sump; Horizontal Centrifugal Pump:^{Q}190m^3/hr × ^{H}82.0m × 45kw × 3units (2 – Standby) Submersible Pump: ^{Q}60m^3/hr × 1 unit	
	Rising Main	D350mm × 2,700m × CIP × 1 Line : Talapona D400mm × 5,870m × CIP × 1 Line : Chapoli	
Treatment Facility	Aerator	Cascade Type: 1 unit	
	Parshal Flume	1 unit (for Chemical Dosing)	
	Clariflocculator	Circular Horizontal Flow Type with Center Feed/Peripheral Collection Flocculation & Clarifier: ^{D}14.0m (Flocc. Zone 7.0m) × ^{WD}3.5m × 2 unit Detention Period: Flocculation – 38.8min Clarifier – 1.9 hrs [1)] Surface Loading for Clarifier: 43.3 m^3/m^2/d (30.1 mm/min) [2)]	1): 2～2.5 hrs 2): 30～40m^3/m^2/d
	Filter	Gravity Rapid Sand Filter Type ^{W}4.80m × ^{L}4.80m × 2cells/basin × 2 basins Effective Size of Sand:0.??mm, Depth of Sand: 0.??m Filter Area: 11.5 m^2/cell, 23.0 m^2/basin Filtration Rate: 4.5 m/hr [3)] (108 m/d) Air Scouring Rate: 51m/hr/cell [4)] (0.??m^3/min/m^2/cell) Backwash Rate: 25.8m/hr/cell [5)] (0.43m^3/min/m^2/cell)- Using 50m^3 Backwash Tank	Based on Specifications of Air Blower & Backwash Pump 3): 4.8～6.0m/hr 4): 36～54m/hr 5): 24～36m/hr
Clear Water Transmission Facility	Clear Water Reservoir (MBR)	GLR-Volume=800 m^3 × 2units, OGR- Volume=300 m^3 × 1unit Retention Time: 7.7 hr	
	Lifting Pump to OHR	Horizontal Centrifugal Pump: ^{Q}169.2m^3/hr × ^{H}30.0m × 22kw × 2units (1 – Standby)	
Chemical Feeding Facility	Alum Feeding Facility	Dry Aluminum Sulfate Solution Tank: 1 unit	
	Lime Feeding Facility	Powder Lime Solution Tank: 1 unit	
	Disinfection Facility	Liquid Chlorine (1 tone Container – net 900kg) Chlorinator: 1 unit	
Laboratory	Frequency of Sampling & Analysis	In-Service, Jar Test: Not in Service Every Hour: pH, Turbidity, R-Cl Fortnightly: 20 Parameters	
Note: 1) ～ 4) are referring to "Manual on Water Supply and Treatment, Third Edition – Revised and Updated, May 1999"			

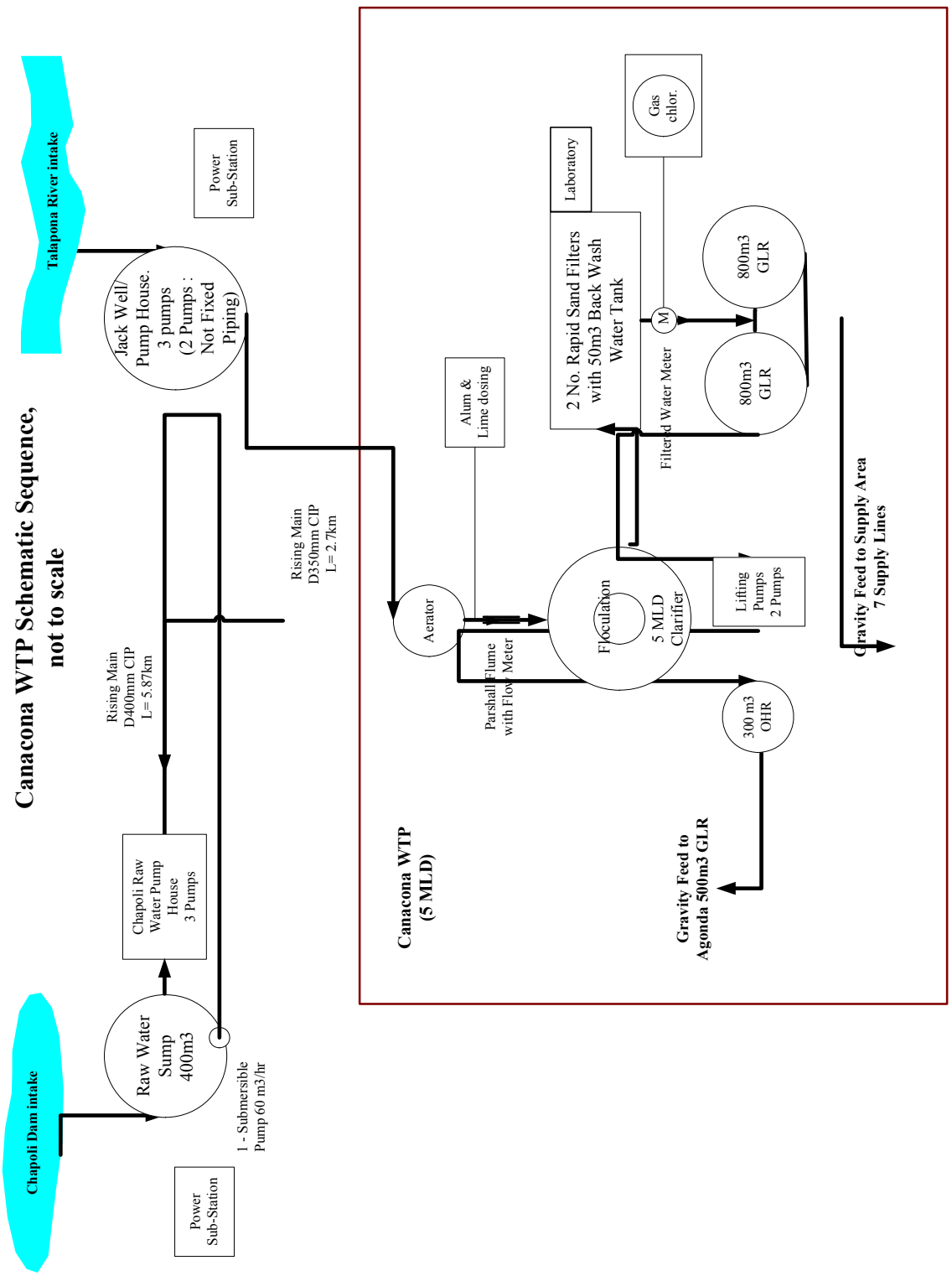

Figure M31.7.1 Schematic Sequence of Canacona Water Treatment Plant

Table M31.7.2 Present Conditions of Canacona Water Treatment Plant (1/4)

Item			Contents		Remarks
Background					
Covered Area for Water Supply		Taluka	Canacona		
Number of W.T.P.		Number	(1)		
Capacity of Plant		MLD	5		
		m^3/d	5,000		
Raw Water Resources		River	Talapona		
		Dam	Chapoli		
Year of Construction		Year	1980 - 81		
Year of Commission		Year	1983		
Expected Aug-mentation Plan			10 MLD		
			Under Tendering		
			3 MLD Pressurized Filter (from Opa)		
Name of Facility			**Contents of Facility**		**Remarks**
Capacity of Raw Water Intake & Water Treatment Plant		MLD	5.00		
		m^3/d	5,000		
Head Water Works : Raw Water Intake					
Name of Raw Water			Talapona	Chapoli	
Intake Well	Diameter	m	10.0		
	Height	m	7.0		
	Water Depth	m			
	Volume	m^3/unit	0.0		
	Water Level of River				
	H.W.L.	m			
	L.W.L	m			
Connecting Pipe	Diameter	mm			
	Length	m			
	Material				
	Velocity	m/sec	#DIV/0!		C=110
	Loss of Head	m	#DIV/0!		: Hazen-Williams Formula
Jack Well & Pump House/Raw Water Sump			Jack Well Pump House	Raw Water Sump	
	Diameter	m	12.0		
	Height	m	3.5		
	Water Depth	m			
	Volume	m^3/unit	0	400	
	Detension Time	min	0.00		
Control Room	Width	m			
	Length	m			
	Area of Floor	m^2	50.00		
Raw Water Pump			Chapoli		Talapona
	Capacity	l/sec	53	16.67	50
		m^3/min	3.17	1.00	3.00
		m^3/hr	190	60	180
		m^3/d	4,560	1,440	4,320
	Number	unit	3	1	3
	Stand-by	unit	2	0	2 : Under Installation
	Total Capacity	m^3/d	5,000		4,000
	Head	m	82.0		87.0
	Type of Pump		Centrifugal Submersible		Centrifugal
	Maker		KBL		KBL
	Year of Manufacture		2003		1997
	Assessment of Condition		Working, Valves Need Replacement		Working
Raw Water Motor	Motor Output	HP	60		100
		kW	45		75
	Number	Unit	3		3
	Maker		KBL		KBL
	Year of Manufacture		2003		1997
	Assessment of Condition		Working		
Raw Water Transmission Line	Diameter	mm	350		400
	Length	m	2,700		5,870
	Material		CIP		CIP
	Velocity	m/sec	0.165		0.145
	Loss of Head	m	4.109		4.662 : Hazen-Williams Formula
	Assessment of Condition	Pipe	Working Condition		
		Valve	Working Condition		
Transformers					
Number of Transformer			(1) Talapona	(2) Chapoli	WTP's Transformer belong to Electric Dep.
Pole Mounted / Pad Mounted			Pad	Pad	
Capacity		kVA	200	300	
Number		Unit	2	2	
Stand-by			-	-	
Commissioned			1997	1997	
Likely Design Life		Year	15	15	
Last Replacement			-	-	
Assessment of Condition			Working	Working	

Table M31.7.2 Present Conditions of Canacona Water Treatment Plant (2/4)

Name of Facility				Contents of Facility	Remarks
Water Treatment Plant					
	Aerator	Capacity	m^3/hr	208.3	
			m^3/d	5,000	
		Number	Unit	1	
		Diameter	m	3.0	
		Height	m	5.0	
		El. of Top Aerator	m	?	
		Assessment of Condition		Working	
	Parshal Flume w/	Number	Unit	1	
		Assessment of Condition		Working	
	Clarifiers / Settling Tank (Coagulation Basin)	Dsign Capacity	m^3/min/unit	3.5	
			m^3/hr/unit	208.3	
			m^3/d/unit	5,000	
		Number	Unit	1	
		Type of Clarifier		Circular horizontal Flow Type with Center Feed/Peripherical Collection	
		Water Depth	m	3.50	
		Overall Diameter	m	14.00	
		Flocc. Zone Dia.	m	7.00	
		Frequency of Desludging		Once a Day : General Season	
				Twice a Day : Monsoon Season	
		Volume			
		Overall	m^3/unit	538.8	
		Flocculation Zone	m^3/unit	134.7	
		Clarifying Zone	m^3/unit	404.1	
		Retention Time			
		Flocculation Zone	min	38.8 OK	
		Clarifying Zone	min	116.4 Less Time	
		Overall	min	155.2	
		Surface Area	m^2/unit	115.5	
		Surface Loading	mm/min	30.1 OK	
		W.L. of Clarifier	m		
		Assessment of Condition		Working Condition	
	Flocculator & Drive Arrangement	Number	unit	1	
		Assessment of Condition		Working	
	Filter	Design Capacity	m^3/hr/unit	104.2	
			m^3/d/unit	2,500	
		Number	Unit	2	
		Type		Rapid Sand Gravity Filter	with 50 m3 Back Wash Tank
		Width	m	4.80 Twin of Size	
		Length	m	4.80	
		Water Depth	m	?	
		Filtered Area	m^2/unit	23.0	
		Velocity	m^3/d/m^2	108.5 OK	
		Filter Media		Standard Size - Good Condition	
		E.S. of Sand	mm	?	: E.S. = Effective Size
		Depth of Sand	mm	?	
		Type of Underdrain System		?	
		Year Replacement of Media		2004 (Every 2 Year)	
		W. L. of Filter	m	?	
		Assessment of Condition		Working Condition	
	Filter Washing Criteria & Method	Air Scouring Rate	m^3/min/m^2		
		Air Scouring Time	min	5.0	
		Backwash Rate	m^3/min/m^2	0.43 OK	
		Backwashing Time	min	10 ～ 15	
		Frequency of Washing		General : Once a Day	
				Monsoon : 2 ～ 3 Times/Day	

Table M31.7.2 Present Conditions of Canacona Water Treatment Plant (3/4)

Name of Facility				Contents of Facility			Remarks
	Backwash Pump & Motor	Capacity	m^3/min			Lifting Pump & Motor	
			m^3/hr				
			m^3/d				
		Number	unit	2			
		Stand-by	unit	1			
		Total Capacity	m^3/min				
			m^3/d				
		Head	m	21/30			
		Type of Pump		Centrifugal			
		Motor Output	HP				
			kW	5.5			
		Assessment of Condition		Working			
	Air Blower	Capacity	m^3/min				
			m^3/hr				
			m^3/d				
		Number	unit	2			
		Stand-by	unit	1			
		Total Capacity	m^3/min				
			m^3/d				
		Head	mm WG				
		Motor Output	HP	30.0			
			kW	20.0			
		Assessment of Condition		Working			
	Master Balancing Reservoir (M.B.R.) / O.H.R. : Clear Water Reservoir	Diameter	m	16.0			
		Water Depth	m	4.0			
		Number	Unit	2			
		Volume	m^3	800	300.0		
		Total	m^3	1,600			
		Detention Time	hr	7.7			
		Last Date of Cleaning		Pediodical			
		Water Level	m				
		Assessment of Condition		Working	Working		
	Lifting to O.H.R. Pump & Motor	Capacity	m^3/min				
			m^3/hr	169.2			
			m^3/d				
		Number	unit	2			
		Stand-by	unit	1			
		Total Capacity	m^3/min				
			m^3/d				
		Head	m	30.0			
		Type of Pump		Centrifugal			
		Motor Output	HP	30.0			
			kW	22.0			
		Assessment of Condition		Working			
Chemical Facility							
	Alum Feeding Facility	Capacity	kg/hr				
			m^3/unit				
		Diameter	m				
		Width	m				
		Length	m				
		Height	m				
		Volume	m^3				
		Number	Unit	1			
		Stand-by					
		Assessment of Condition		Working			

Table M31.7.2 Present Conditions of Canacona Water Treatment Plant (4/4)

Name of Facility				Contents of Facility	Remarks
Lime Feeding Facility	Capacity	kg/hr			
		m^3/unit			
	Diameter	m			
	Width	m			
	Length	m			
	Height	m			
	Volume	m^3			
	Number	Unit		1	
	Stand-by				
	Assessment of Condition			Working	
Disinfection System	Chemical Used			Liquid Chlorine	
	Type of Plant & Machinery			Chlorinator	
	Capacity	kg/hr		2.0	
	Number	Unit		1	
	Stand-by				
	Safty Measures Taken			Emersion Tank	
	Commissioned			1983	
	Assessment of Condition			Working	
Laboratory					
Chemical Testing Laboratory				In-service (Exists)	
Jar Testing				Nil	
Availability of Skilled Chemists				Lab. Technician & Chemical Operators	
Availability of Required Chemicals				Required Alum, Lime & Liquid Chlorine	
Use of Test Reports				As per Format	
Frequency of Sampling & Analysis				Hourly (pH, Turb., R-Cl)	
				20 Parameter Tests Monthly	
General Quality of Water				Good	
	Raw Water Quality			Turbid., Low pH	
	Clear Water Quality			Good	
Equipment Status					
Flow Meters				Not Provided	
Other Operating Valves				Working	
Other Important Assets					
Valve's Condition				Working	
Visible Leakage and Locations				Nil	
Building Condition					
Wastewater Disposal Arrangements				Nalla	
Organization & Staff Deployed					
Shift in Plant Operation	Shifting System			3 Shifting System Covering 24 Hours	
	Working Hour :			①: 07:00 → 15:00 , ②: 15:00 → 18:00 , ③: 18:00 → 08:00	
	Grouping Staff Deployed :			① : Morning Shift- 2 Persons	
				② : General Shift- 4 Persons	
				③ : Night Shift- 3 Persons	

Staff Deployed at the Plant		Person	Qualification	Year of Service	Service at plant
Management Staff - Engineers					
	Assistant Engineer	1	D.C.E.	25	2
	Junior Engineer	1	D.C.E.	23	17
	Sub-total	2			
Skilled Staff - Operators / Quality Testing					
	Lab - Technician	1	B.Sc	10	7
	Chemical Operator	1	S.S.C.	10	7
	Assist. Plumber	2	Certificate	15	7
	Lacour	2	I.T.I.	15	7
	Watchman	3	S.S.C.	15	7
	Sub-total	9			
Unskilled Staff		9 - Other Labourers, Watchman, Security Guards			
Total Number		20			

Table M31.7.3 Monthly Water Quality of Canacona Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

	Color			Odor			Taste			Turbidity (NTU)			pH			Specific Conductivity (/u mhos/cm)			Total Solids (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03				Unobjectable			Unobjectable														
Feb-03				Unobjectable			Unobjectable														
Mar-03				Unobjectable			Unobjectable														
Apr-03				Unobjectable			Unobjectable														
May-03				Unobjectable			Unobjectable														
Jun-03				Unobjectable			Unobjectable														
Jul-03				Unobjectable			Unobjectable														
Aug-03				Unobjectable			Unobjectable														
Sep-03				Unobjectable			Unobjectable														
Oct-03				Unobjectable			Unobjectable														
Nov-03				Unobjectable			Unobjectable														
Dec-03	0.0	0.0	0.0	Unobjectable			Unobjectable			8.2	1.0	1.5	7.2	6.9	7.1	62.6	63.0	64.5	43.0	40.0	41.0
Jan-04	0.0	0.0	0.0	Unobjectable			Unobjectable			2.8	0.7	0.5	6.8	7.0	7.1	64.9	66.4	57.1	42.5	42.0	43.0
Feb-04	0.0	0.0	0.0	Unobjectable			Unobjectable			2.8	0.7	0.5	7.7	7.3	7.2	64.9	70.2	70.0	41.3	45.0	45.0
Mar-04	0.0	0.0	0.0	Unobjectable			Unobjectable			1.6	0.4	0.4	6.9	7.0	7.1	72.5	72.4	76.5	46.0	46.0	48.0
Apr-04				Unobjectable			Unobjectable														
May-04	0.0	0.0	0.0	Unobjectable			Unobjectable			3.2	1.7	1.5	7.1	6.9	6.6	71.6	72.3	73.3	47.0	47.0	48.0
Jun-04	0.0	0.0	0.0	Unobjectable			Unobjectable			30.2	4.9	2.5	6.7	6.4	6.5	75.1	100.9	88.2	58.0	66.0	56.5
Jul-04	0.0	0.0	0.0	Unobjectable			Unobjectable			12.0	1.5	1.6	7.0	6.8	7.0	67.5	81.7	69.6	46.0	52.0	44.5
Aug-04	0.0	0.0	0.0	Unobjectable			Unobjectable			9.0	2.1	2.0	7.0	7.0	7.0	68.8	69.1	70.5	46.5	44.0	45.0
Sep-04	0.0	0.0	0.0	Unobjectable			Unobjectable			9.5	2.5	2.5	7.0	7.0	6.9	68.8	69.7	70.4	47.0	44.5	45.0
Oct-04	0.0	0.0	0.0	Unobjectable			Unobjectable			5.5	2.0	2.5	6.9	6.9	7.1	67.2	68.8	69.3	45.0	44.0	45.0
Nov-04	0.0	0.0	0.0	Unobjectable			Unobjectable			4.8	2.3	2.2	6.0	6.0	7.1	69.4	70.7	72.3	45.5	44.5	45.0
Dec-04	0.0	0.0	0.0	Unobjectable			Unobjectable			8.1	2.5	1.7	7.3	7.3	7.3	69.2	69.6	69.4	46.5	46.5	44.5
Jan-05	0.0	0.0	0.0	Unobjectable			Unobjectable			3.0	2.0	1.7	7.3	7.1	7.1	62.8	63.0	66.0	41.0	40.0	42.0
Feb-05	0.0	0.0	0.0	Unobjectable			Unobjectable			3.0	1.5	1.0	6.8	7.0	7.1	64.8	65.1	65.2	42.0	41.5	41.5
Mar-05	0.0	0.0	0.0	Unobjectable			Unobjectable			2.8	1.4	1.3	6.8	7.0	7.0	68.5	68.9	70.5	44.5	44.0	45.0
Apr-05	0.0	0.0	0.0	Unobjectable			Unobjectable			9.0	2.0	1.8	7.2	6.8	6.8	75.9	78.9	79.1	51.5	50.0	50.0
May-05	0.0	0.0	0.0	Unobjectable			Unobjectable			4.4	2.0	2.1	7.3	7.2	7.2	76.9	78.0	78.5	50.5	50.5	50.0
Max	0.0	0.0	0.0							30.2	4.9	2.5	7.7	7.3	7.3	76.9	100.9	88.2	58.0	66.0	56.5
Min	0.0	0.0	0.0	Unobjectable			Unobjectable			1.6	0.4	0.4	6.0	6.0	6.5	62.6	63.0	57.1	41.0	40.0	41.0
Average	0.0	0.0	0.0							7.1	1.8	1.6	7.0	6.9	7.0	68.9	72.3	71.2	46.1	46.3	45.8

	Total Dissolved Solids(TDS) (mg/L)			Suspended Solids (mg/L)			Total Hardness as $CaCO_3$ (TA (mg/L)			Ca^{2+} (mg/L)			Mg^{2+} (mg/L)			Cl^- (mg/L)			Total Alkalinity as $CaCO_3$ (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03																					
Feb-03																					
Mar-03																					
Apr-03																					
May-03																					
Jun-03																					
Jul-03																					
Aug-03																					
Sep-03																					
Oct-03																					
Nov-03																					
Dec-03	40.0	40.0	41.0	3.0	0.0	0.0	20.0	20.0	20.0	4.8	4.8	4.8	2.00	2.00	2.00	6.0	6.0	7.0	26.0	21.0	22.0
Jan-04	41.5	42.0	43.0	1.0	0.0	0.0	23.0	24.0	24.0	4.3	5.2	5.2	2.75	2.75	2.75	6.0	6.0	6.0	25.0	26.0	26.0
Feb-04	40.5	45.0	45.0	1.0	0.0	0.0	22.0	22.0	22.0	4.4	4.8	4.8	2.50	2.50	2.50	6.0	8.0	8.0	30.0	29.0	29.0
Mar-04	46.0	46.0	48.0	0.0	0.0	0.0	23.0	23.0	23.0	5.2	5.2	5.2	2.50	2.50	2.50	6.0	6.0	6.0	27.0	28.0	28.0
Apr-04																					
May-04	46.0	47.0	48.0	1.0	0.0	0.0	24.0	24.0	24.0	5.2	5.2	5.2	2.75	2.75	2.75	7.0	7.0	9.0	28.0	28.0	28.0
Jun-04	48.0	65.0	56.5	10.0	1.0	0.0	28.0	38.0	31.0	6.4	9.2	7.2	3.00	3.75	3.25	7.0	8.0	12.0	30.0	42.0	35.0
Jul-04	43.0	52.0	44.5	3.0	0.0	0.0	21.0	24.0	22.0	4.8	5.6	5.2	2.25	2.50	2.25	7.0	7.0	7.0	22.0	23.0	24.0
Aug-04	44.0	44.0	45.0	2.5	0.0	0.0	23.0	23.0	23.0	5.2	5.2	5.2	2.50	2.50	2.50	6.0	6.0	10.0	25.0	25.0	25.0
Sep-04	44.0	44.5	45.0	3.0	0.0	0.0	23.0	24.0	24.0	6.0	6.4	6.4	2.00	2.00	2.00	7.0	7.0	8.0	24.0	25.0	25.0
Oct-04	43.0	44.0	45.0	2.0	0.0	0.0	22.0	24.0	24.0	5.6	6.0	6.0	2.00	2.25	2.25	6.0	6.0	9.0	25.0	26.0	26.0
Nov-04	44.0	44.5	45.0	1.5	0.0	0.0	22.0	22.0	22.0	4.8	4.8	4.8	2.50	2.50	2.50	7.0	7.0	8.0	26.0	26.0	26.0
Dec-04	44.0	44.5	45.0	2.5	0.0	0.0	23.0	23.0	23.0	4.8	4.8	4.8	2.75	2.75	2.75	7.0	7.0	7.0	26.0	26.0	24.0
Jan-05	40.0	40.0	42.0	1.0	0.0	0.0	19.0	19.0	19.0	4.4	4.4	4.4	2.75	2.00	2.00	7.0	7.0	7.0	22.0	22.0	22.0
Feb-05	41.0	41.5	41.5	1.0	0.0	0.0	21.0	21.0	21.0	4.8	4.8	4.8	2.75	2.25	2.25	8.0	8.0	8.0	0.0	0.0	0.0
Mar-05	44.0	44.0	44.0	0.5	0.0	0.0	22.0	22.0	22.0	5.6	5.6	5.6	2.75	2.00	2.00	7.0	7.0	9.0	23.0	24.0	24.0
Apr-05	48.5	50.0	50.0	3.0	0.0	0.0	20.0	22.0	22.0	4.8	5.6	5.6	2.75	2.00	2.00	9.0	10.0	10.0	27.0	24.0	24.0
May-05	49.0	50.0	50.0	1.5	0.0	0.0	27.0	27.0	27.0	5.6	5.6	5.6	2.75	3.25	3.25	8.0	8.0	8.0	25.0	26.0	24.0
Max	49.0	65.0	56.5	10.0	1.0	0.0	28.0	38.0	31.0	6.4	9.2	7.2	3.00	3.75	3.25	9.0	10.0	12.0	30.0	42.0	35.0
Min	40.0	40.0	41.0	0.0	0.0	0.0	19.0	19.0	19.0	4.3	4.4	4.4	2.00	2.00	2.00	6.0	6.0	6.0	0.0	0.0	0.0
Average	43.9	46.1	45.8	2.2	0.1	0.0	22.5	23.6	23.1	5.1	5.5	5.3	2.54	2.49	2.44	6.9	7.1	8.2	24.2	24.8	24.2

Table M31.7.3 Monthly Water Quality of Canacona Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

	SO_4^- (mg/L)			Fe^{2+} (mg/L)			Mn^{2+} (mg/L)			NO_3^{2-} (mg/L)			$KMnO_4$ oxidizability as O_2 (mg/L)			BOD at 27°C and 3days (mg/L)			DO (mg/L)		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03																					
Feb-03																					
Mar-03																					
Apr-03																					
May-03																					
Jun-03																					
Jul-03																					
Aug-03																					
Sep-03																					
Oct-03																					
Nov-03																					
Dec-03	0.0	0.0	0.0	2.00	0.40	0.40	0.00	0.00	0.00	1.7	0.6	0.0	1.2	0.2	0.0	1.6	0.5	0.0	7.0	6.8	7.2
Jan-04	0.0	0.0	0.0	0.45	0.10	0.10	0.00	0.00	0.00	0.8	0.0	0.0	0.3	0.0	0.0	0.5	0.0	0.0	7.3	7.5	7.5
Feb-04	0.0	0.0	0.0	0.20	0.06	0.06	0.00	0.00	0.00	0.8	0.0	0.0	0.2	0.0	0.0	0.6	0.0	0.0	7.4	7.5	7.5
Mar-04	0.0	0.0	0.0	0.12	0.05	0.05	0.00	0.00	0.00	0.6	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	6.8	7.8	7.4
Apr-04																					
May-04	0.0	0.0	0.0	0.40	0.08	0.08	0.00	0.00	0.00	0.6	0.0	0.0	0.3	0.0	0.0	0.8	0.0	0.0	6.9	7.1	7.3
Jun-04	0.0	0.0	0.0	3.00	0.15	0.10	0.35	0.00	0.00	1.6	0.0	0.0	1.0	0.0	0.0	2.2	0.0	0.0	6.5	7.0	7.3
Jul-04	0.0	0.0	0.0	0.65	0.10	0.10	0.00	0.00	0.00	1.0	0.0	0.0	0.5	0.0	0.0	1.2	0.0	0.0	7.0	7.1	7.1
Aug-04	0.0	0.0	0.0	0.50	0.15	0.15	0.00	0.00	0.00	0.9	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	7.2	7.4	7.4
Sep-04	0.0	0.0	0.0	1.00	0.20	0.20	0.00	0.00	0.00	0.5	0.0	0.0	0.6	0.0	0.0	1.2	0.0	0.0	7.4	7.5	7.5
Oct-04	0.0	0.0	0.0	0.40	0.10	0.10	0.00	0.00	0.00	0.4	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.3	7.4	7.4
Nov-04	0.0	0.0	0.0	0.40	0.20	0.20	0.00	0.00	0.00	0.4	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.1	7.2	7.3
Dec-04	0.0	0.0	0.0	0.65	0.15	0.12	0.00	0.00	0.00	0.5	0.0	0.0	0.4	0.2	0.0	1.2	0.0	0.0	7.2	7.2	7.3
Jan-05	0.0	0.0	0.0	0.35	0.15	0.15	0.00	0.00	0.00	0.4	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.2	7.3	7.3
Feb-05	0.0	0.0	0.0	0.35	0.06	0.06	0.00	0.00	0.00	0.7	0.0	0.0	0.4	0.0	0.0	0.9	0.0	0.0	7.2	7.4	7.4
Mar-05	0.0	0.0	0.0	0.40	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	7.4	7.5	7.5
Apr-05	0.0	0.0	0.0	0.60	0.06	0.06	0.00	0.00	0.00	0.9	0.0	0.0	0.6	0.0	0.0	1.4	0.0	0.0	7.4	7.6	7.6
May-05	0.0	0.0	0.0	0.30	0.10	0.10	0.00	0.00	0.00	0.6	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	6.9	7.2	7.3
Max	0.0	0.0	0.0	3.00	0.40	0.40	0.35	0.00	0.00	1.7	0.6	0.0	1.2	0.2	0.0	2.2	0.5	0.0	7.4	7.8	7.6
Min	0.0	0.0	0.0	0.12	0.05	0.05	0.00	0.00	0.00	0.4	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	6.5	6.8	7.1
Average	0.0	0.0	0.0	0.69	0.13	0.13	0.02	0.00	0.00	0.8	0.0	0.0	0.5	0.0	0.0	1.0	0.0	0.0	7.1	7.3	7.4

	F^- (mg/L)			Al^{3+} (mg/L)			Plate Count on nutrient agar no/100mL			MPN of Coliform no/100mL			MPN of E.Coli. no/100mL		
	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated	Raw	Filtered	Treated
Jan-03															
Feb-03															
Mar-03															
Apr-03															
May-03															
Jun-03															
Jul-03															
Aug-03															
Sep-03															
Oct-03															
Nov-03															
Dec-03	0.0	0.0	0.0				288	83	0	240	43	0	93	23	0
Jan-04	0.0	0.0	0.0		0.00	0.00									
Feb-04	0.0	0.0	0.0			0.00	192	140	4	460	240	0	240	93	0
Mar-04	0.0	0.0	0.0		0.00	0.00	213	108	3	2,460	460	0	460	150	0
Apr-04															
May-04	0.0	0.0	0.0		0.00	0.00	220	118	4	2,400	1,100	0	460	460	0
Jun-04	0.0	0.0	0.0	0.00	0.00	0.00	198	120	5	2,400	1,100	0	1,100	210	0
Jul-04	0.0	0.0	0.0		0.00	0.00	98	61	5	2,400	240	0	930	93	0
Aug-04	0.0	0.0	0.0	0.00	0.01	0.01	138	45	2	460	240	0	240	93	0
Sep-04	0.0	0.0	0.0	0.00	0.01	0.01	274	170	1	2,400	1,100	0	460	460	0
Oct-04	0.0	0.0	0.0	0.00	0.01	0.01	128	45	3	1,100	240	0	460	240	0
Nov-04	0.0	0.0	0.0	0.00	0.01	0.01	84	65	2	1,100	460	0	64	11	0
Dec-04	0.0	0.0	0.0		0.01	0.01	68	52	4	2,400	1,100	0	460	150	0
Jan-05	0.0	0.0	0.0	0.00	0.01	0.01	160	24	1	2,400	240	0	240	23	0
Feb-05	0.0	0.0	0.0	0.00	0.00	0.00	226	31	4	2,400	43	0	1,100	23	0
Mar-05	0.0	0.0	0.0	0.00	0.00	0.00	42	32	4	150	93	0	43	23	0
Apr-05	0.0	0.0	0.0	0.00	0.00	0.00	38	7	1	43	0	0	23	0	0
May-05	0.0	0.0	0.0	0.00	0.00	0.00	112	63	6	1,100	460	0	93	210	0
Max	0.0	0.0	0.0	0.00	0.01	0.01	288	170	6	2,460	1,100	0	1,100	460	0
Min	0.0	0.0	0.0	0.00	0.00	0.00	38	7	0	43	0	0	23	0	0
Average	0.0	0.0	0.0	0.00	0.00	0.00	155	73	3	1,495	447	0	404	141	0

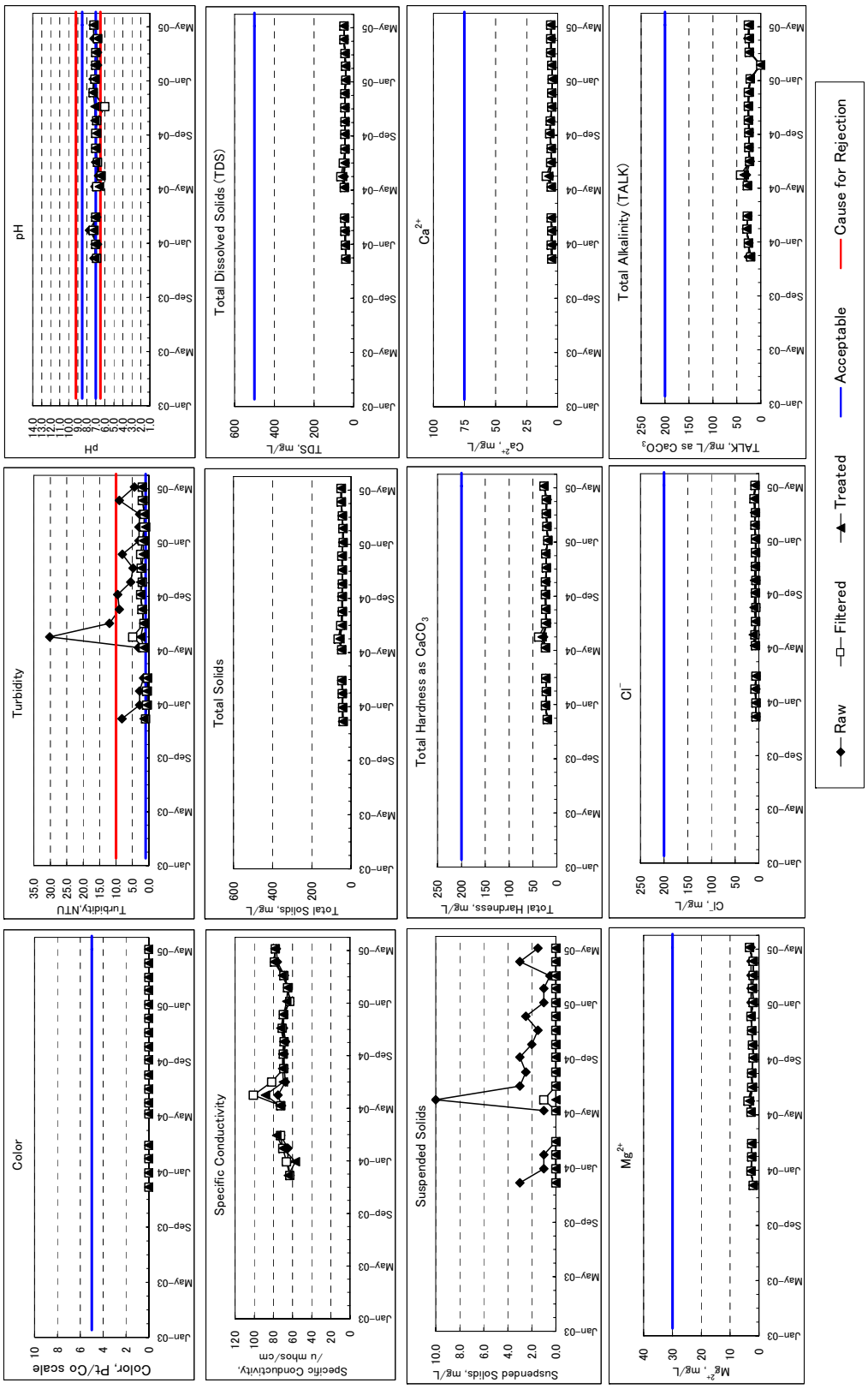

Figure M31.7.2 Monthly Water Quality of Canacona Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (1/2)

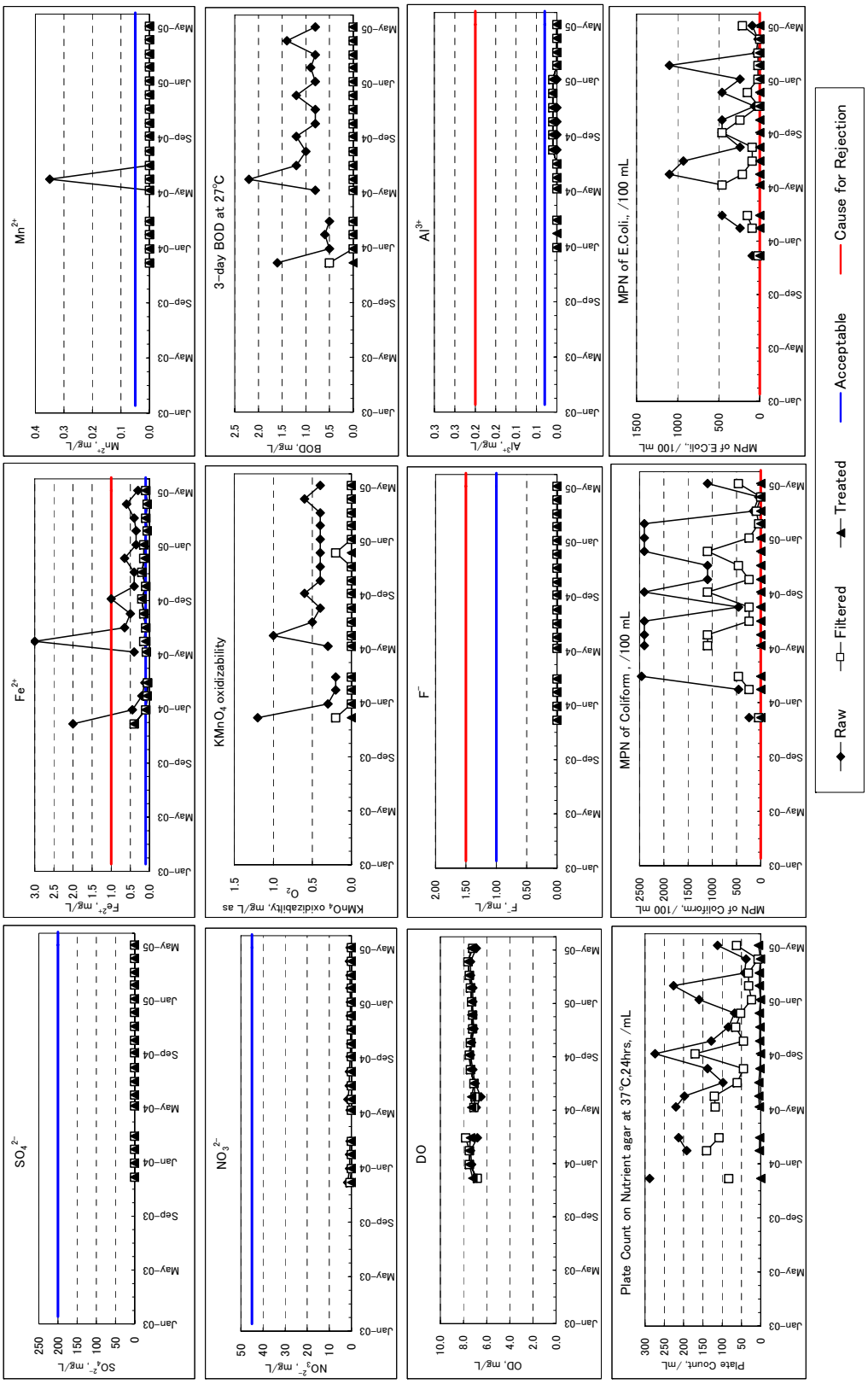

Figure M31.7.2 Monthly Water Quality of Canacona Water Treatment Plant Analysed by PWD's Laboratory from January 2003 to May 2005 (2/2)

Table M31.7.4 List of Reservoirs for the Canacona Water Supply Scheme

Series No.	System	Inlet Pipe		Name of GLR/OHR/Sump (Name of Location)	GLR/OHR/Sump				Supply Area (Village Name)	Remarks
		Dia. (mm)	Material		Type	Capacity (m3)	Elevation (m)			
							RL	HWL	LWL	
1	Canacona			Canacona WTP	GLR	800		67.00	63.00	Canacona(4), Canacona(M Cl)(9)	
2					GLR	800		67.00	63.00		
3					OHR	300		85.00	81.00		w/ Pumping Station
				Sub-Total		**1,900**					
4	Canacona1			Godkamol (2000)	GLR	50			30.00	Poinguinim(6)	
5				Sadolxem	GLR	50			30.00		Old
6				Sadolxem (2000)	GLR	100			32.00		
7				Talpona	GLR	100			15.00		under Construction of Distribution Main
8				Galjibaga	GLR	100			25.00		under Construction of Distribution Main
9				Mahalwada	GLR	50			30.00		under Construction of Distribution Main
10				Maxem	GLR	400			22.00	Loliem(7)	under Construction of Distribution Main
				Sub-Total		**850**					
11	Canacona2	150	ACP	Hattipal	Sump	10	16.00			Poinguinim(6)	w/Pump Station (5HP)
12		150	ACP		GLR	50			100.00		
				Sub-Total		**60**					
13	Canacona5	350	DIP	Agonda MBR (2001)	GLR	500			59.00		from OHR(Series No.3) of WTP
14		200	PVC	Agonda (2000)	GLR	400			44.00	Agonda(3)	
				Sub-Total		**900**					
15	Canacona7	80	ACP	Shristhal	GLR	50			90.00	Canacona(4)	w/Pump Station (5HP), GL=54.0
				Sub-Total		**50**					
	Total					**3,760**					
						18.0 hrs					

Note : RL=Reduced Level (Base Elevation of GLR), HWL=High Water Level in Reservoir, LWL=Law Water Level in Reservoir, GLR=Ground Level Reservoir, OHR=Over Head Reservoir, MBR=Master Balancing Reservoir, Sump=Pump Suction Well

M31.8 Rural Water Supply Scheme

During the Reconnaissance Survey as part of Phase I of this study, the water supply scheme in Canacona taluka was selected and assessed as a representative small scale water supply scheme. The Canacona scheme was selected based on recommendations from PWD staff. There are approximately 40 rural water supply schemes operating in the Canacona taluka and the networks for these schemes are completely independent from each other as well as form the regional scheme. The rural supply scheme at Matve, which supplies water to Parekatta, was visited.

The Matve scheme consists of a pump house (manned 24 hours a day) with a small (five HP) submersible pump suspended in a bore well, which is approximately 160m deep. The scheme was commissioned in 1991. Bore wells in Goa are constructed by the Central Ground Water Board on behalf of the PHE. The pump feeds a $25m^3$ OHR which feeds water to the village under gravity flow. A chlorine solution (5%) is added to the OHR (from 25 litre plastic containers) to maintain residual levels. The study team could not determine whether residual chlorine levels are regularly tested. There is no standby pump which means villagers can go without water for days at a time if the pump breaks down.

The study team understood that the scheme supplies a population of approximately 1000 people. Water is supplied for approximately two to three hours each day. The supply valves are controlled by PHE staff. There are approximately 25 private connections and 25 public stand posts. There is no charge for water consumed from stand posts in rural or urban areas and consumption is not measured.

Table M31.8.1 lists the small scale (rural) water supply schemes in each taluka, which data are mentioned in “Sector Status Study – WSS Goa, 2004”. Table M31.8.2 also shows the rural water supply schemes, which are based on the information from PWD during the study period.

Table M31.8.1 List of Rural Water Supply Scheme (1/2)

Sr.No.	ID No.	Taluka	Town/Village	Type	Population	Household	H. Size	W. Scheme
1	101001	Pernem	Tiracol	Rural	221	46	4.8	Groundwater
87	103015	Tiswadi	Talaulim	Rural	667	139	4.8	Groundwater
88	103016	Tiswadi	Goalim Moula	Rural	385	74	5.2	Groundwater
92	103020	Tiswadi	Gancim	Rural	571	112	5.1	Groundwater
94	103022	Tiswadi	Curca	Rural	2,078	424	4.9	Groundwater
110	104001	Bicholim	Mencurem	Rural	1,386	252	5.5	Groundwater
111	104002	Bicholim	Dumacem	Rural	325	55	5.9	Groundwater
112	104003	Bicholim	Salem	Rural	2,770	577	4.8	Groundwater
113	104004	Bicholim	Latambarcem	Rural	6,268	1,229	5.1	Groundwater
119	104010	Bicholim	Curchirem	Rural	1,914	368	5.2	Groundwater
129	104020	Bicholim	Cotombi	Rural	985	197	5.0	Groundwater
136	105001	Satari	Podocem	Rural	994	216	4.6	Groundwater
138	105003	Satari	Ravona	Rural	1,204	223	5.4	Groundwater
139	105004	Satari	Gonteli	Rural	1,424	303	4.7	Groundwater
140	105005	Satari	Siroli	Rural	634	122	5.2	Groundwater
141	105006	Satari	Ponsuli	Rural	4	1	4.0	Groundwater
145	105010	Satari	Golauli	Rural	288	60	4.8	Groundwater
146	105011	Satari	Surla	Rural	423	92	4.6	Groundwater
147	105012	Satari	Satrem	Rural	140	26	5.4	Groundwater
148	105013	Satari	Derodem	Rural	112	22	5.1	Groundwater
149	105014	Satari	Codal	Rural	140	31	4.5	Groundwater
150	105015	Satari	Rivem	Rural	141	30	4.7	Groundwater
153	105018	Satari	Gululem	Rural	42	10	4.2	Groundwater
154	105019	Satari	Querim	Rural	2,063	421	4.9	Groundwater
155	105020	Satari	Morlem	Rural	3,210	655	4.9	Groundwater
164	105029	Satari	Xelopo-Buzruco	Rural	237	55	4.3	Groundwater
165	105030	Satari	Sigonem	Rural	170	34	5.0	Groundwater
166	105031	Satari	Maloli	Rural	384	80	4.8	Groundwater
167	105032	Satari	Nanorem	Rural	271	59	4.6	Groundwater
168	105033	Satari	Vainguinim	Rural	25	5	5.0	Groundwater
169	105034	Satari	Ustem	Rural	332	65	5.1	Groundwater
177	105042	Satari	Cumarconda	Rural	477	90	5.3	Groundwater
180	105045	Satari	Vaguriem	Rural	277	47	5.9	Groundwater
187	105052	Satari	Codvol	Rural	6	1	6.0	Groundwater
188	105053	Satari	Caranzol	Rural	806	152	5.3	Groundwater
189	105054	Satari	Carambolim-Buzr	Rural	473	83	5.7	Groundwater
194	105059	Satari	Ponocem	Rural	470	84	5.6	Groundwater
201	105066	Satari	Xelopo-Curdo	Rural	254	47	5.4	Groundwater
202	105067	Satari	Siranguli	Rural	77	15	5.1	Groundwater
203	105068	Satari	Sirsodem	Rural	257	45	5.7	Groundwater
204	105069	Satari	Assodem	Rural	136	23	5.9	Groundwater
205	105070	Satari	Govanem	Rural	204	40	5.1	Groundwater
207	105072	Satari	Ambeli	Rural	101	21	4.8	Groundwater
235	106025	Ponda	Conxem	Rural	202	43	4.7	Groundwater
323	203019	Quepem	Quitol	Rural	1,404	312	4.5	Groundwater
324	203020	Quepem	Naquerim	Rural	740	185	4.0	Groundwater
325	203021	Quepem	Morpila	Rural	2,631	446	5.9	Groundwater
326	203022	Quepem	Tiloi	Rural	615	123	5.0	Groundwater
327	203023	Quepem	Bendordem	Rural	621	109	5.7	Groundwater
328	203024	Quepem	Cavorem	Rural	778	162	4.8	Groundwater
329	203025	Quepem	Maina	Rural	388	68	5.7	Groundwater

Source: Sector Status Study – WSS Goa, 2004

Table M31.8.1 List of Rural Water Supply Scheme (2/2)

Sr.No.	ID No.	Taluka	Town/Village	Type	Population	Household	H. Size	W. Scheme
330	203026	Quepem	Cordem	Rural	1,747	312	5.6	Groundwater
331	203027	Quepem	Padi	Rural	471	76	6.2	Groundwater
332	203028	Quepem	Quedem	Rural	372	60	6.2	Groundwater
333	203029	Quepem	Barcem	Rural	2,179	283	7.7	Groundwater
334	203030	Quepem	Gocoldem	Rural	484	78	6.2	Groundwater
335	203031	Quepem	Quisconda	Rural	441	70	6.3	Groundwater
336	203032	Quepem	Pirla	Rural	488	106	4.6	Groundwater
337	203033	Quepem	Sulcorna	Rural	646	91	7.1	Groundwater
338	203034	Quepem	Corla	Rural	183	29	6.3	Groundwater
339	203035	Quepem	Cazur	Rural	461	96	4.8	Groundwater
340	203036	Quepem	Mangal	Rural	304	76	4.0	Groundwater
343	204001	Sanguem	Piliem	Rural	4,163	925	4.5	Groundwater
344	204002	Sanguem	Darbandora	Rural	3,137	682	4.6	Groundwater
345	204003	Sanguem	Sancordem	Rural	1,077	291	3.7	Groundwater
346	204004	Sanguem	Aglote	Rural	1,700	340	5.0	Groundwater
347	204005	Sanguem	Surla	Rural	1,050	210	5.0	Groundwater
348	204006	Sanguem	Molem	Rural	1,551	330	4.7	Groundwater
349	204007	Sanguem	Caranzol	Rural	27	17	1.6	Groundwater
350	204008	Sanguem	Colem	Rural	3,794	843	4.5	Groundwater
351	204009	Sanguem	Sigao	Rural	1,633	355	4.6	Groundwater
352	204010	Sanguem	Sangod	Rural	977	222	4.4	Groundwater
353	204011	Sanguem	Cormonem	Rural	750	163	4.6	Groundwater
354	204012	Sanguem	Codli	Rural	3,822	780	4.9	Groundwater
355	204013	Sanguem	Camarconda	Rural	804	164	4.9	Groundwater
356	204014	Sanguem	Moissal	Rural	82	7	11.7	Groundwater
357	204015	Sanguem	Bandoli	Rural	1,382	271	5.1	Groundwater
358	204016	Sanguem	Rumbrem	Rural	924	149	6.2	Groundwater
359	204017	Sanguem	Antoriem	Rural	17	3	5.7	Groundwater
360	204018	Sanguem	Santona	Rural	1,049	233	4.5	Groundwater
361	204019	Sanguem	Calem	Rural	2,605	521	5.0	Groundwater
362	204020	Sanguem	Sonauli	Rural	78	30	2.6	Groundwater
364	204022	Sanguem	Patiem	Rural	315	63	5.0	Groundwater
365	204023	Sanguem	Maulinguem	Rural	227	42	5.4	Groundwater
366	204024	Sanguem	Dudal	Rural	572	110	5.2	Groundwater
369	204027	Sanguem	Comproi	Rural	637	130	4.9	Groundwater
375	204033	Sanguem	Tudou	Rural	194	54	3.6	Groundwater
376	204034	Sanguem	Potrem	Rural	141	32	4.4	Groundwater
377	204035	Sanguem	Bati	Rural	1,963	409	4.8	Groundwater
378	204036	Sanguem	Cumbari	Rural	221	45	4.9	Groundwater
379	204037	Sanguem	Viliena	Rural	547	114	4.8	Groundwater
380	204038	Sanguem	Dongor	Rural	29	8	3.6	Groundwater
381	204039	Sanguem	Naiquinim	Rural	230	56	4.1	Groundwater
382	204040	Sanguem	Porteem	Rural	2,560	483	5.3	Groundwater
386	204044	Sanguem	Curpem	Rural	882	180	4.9	Groundwater
387	204045	Sanguem	Vichundrem	Rural	726	165	4.4	Groundwater
388	204046	Sanguem	Netorli	Rural	1,787	397	4.5	Groundwater
389	204047	Sanguem	Nundem	Rural	408	102	4.0	Groundwater
390	204048	Sanguem	Verlem	Rural	886	206	4.3	Groundwater
393	205002	Canacon	Cola	Rural	5,114	947	5.4	Groundwater
396	205005	Canacon	Gaodongrem	Rural	5,168	891	5.8	Groundwater
399	205008	Canacon	Cotigao	Rural	2,703	575	4.7	Groundwater

Source: Sector Status Study – WSS Goa, 2004

Table M31.8.2 List of Rural Water Supply Scheme (1/7)

Taluka	Name of Scheme	Source	Pump Capacity (HP)	Capacity of Tank (m^3)	Population covered	Supply Amount (m^3/day)	Remarks
Quepem	Barcem						
	Gokuldem	open/bore well	5	25 GLR	471	-	chlorination
	Barcem (Rawapan)	spring/bore well	5	50 GLR	2,079	-	
	(Valipwada)		5	25 GLR		-	
	Paddi	borewell	5	50 GLR	400	-	
	Voili-Paddi	borewell	5	25 GLR	463	-	
	Khedem-Assodem	spring/borewell	5	-	379	-	
	Subdolem	borewell	5	25 GLR	560	-	
	Quiscond	spring	-	-	440	-	
	Sirlim	spring	-	-	275	-	
	Balli						
	Bondordem	2borewells	5	25 GLR	575	-	chlorination
	Cordem	borewell	5	50 GLR	1,723	-	
	Fatorpa						
	Quittol	borewell/Jackwell	6	25 GLR	1,393	-	chlorination
	Ventem	borewell	5	25 GLR	260	-	
	Morppila						
	Dhabem	borewell	5	50 GLR	445	-	chlorination
	Morpila	spring/Salaulimwat	5	50 GLR	2,066	-	
	Betul						
	Naqueri	borewell	5	-	90	-	chlorination
	Dessaiwada	openwell	10	25 GLR	480	-	
	Betul(Bapsora)	openwell	20	50 GLR	640	-	
	Betul	spring	12.5	25 GLR	450	-	
	Khana	spring	4.5	25 GLR	612	-	
	Tembi	openwell	6	25 GLR	315	-	
	Ollir	spring	5	25 GLR	280	-	
	Cavrem-Pirla						
	Pirla	borewell	5	25 GLR	443	-	chlorination
	Sulcorna	borewell/spring	5	25 GLR	638	-	
	Cazur	borewell	6	50 GLR	462	-	
	Mangal	openwell	5	10 GLR	313	-	
	Maina	spring	-	25 GLR	297	-	
	Cauvrem	spring	-	700 GLR	777	-	
	Nanagotov	spring	-	35 GLR	50	-	
	Corla	openwell	2	2 tanks	184	-	
Sanguem	Sancorda						
	Tamoisurla	borewell	3.5	-	4,031	30	
	Butter	borewell	3.5	-		25	chlorination
	Panas	river	15+15=30	100		100	pressure filters and chlorination
	Satpal	river	3.5	50 GLR		30	chlorination(pressure filters proposed)
	Dongarwada	openwell	3.5	30		25	chlorination
	Mollem						
	Mollem	borewell	7.5+3=10.5	50 OHR	2,685	50	chlorination(pressure filters proposed)
	Sangod	borewell	5	-		40	
	Barkatem	openwell	3.5	50 GLR		25	
	Casaulim	openwell	3.5	-		25	

Source: PWD Goa - as of May 2006

Table M31.8.2 List of Rural Water Supply Scheme (2/7)

Taluka	Name of Scheme		Source	Pump Capacity (HP)	Capacity of Tank (m^3)	Population covered	Supply Amount (m^3/day)	Remarks
Sanguem	Collem							
		Collem	borewell	3.5	50 OHR	5,648	-	chlorination(pressure filters shall be installed shortly)
		Near bridge	river	10	-		-	chlorination(pressure filters shall be installed shortly)
		Dudhsagar	river	17.5 (Repaired pump)	50 OHR		-	chlorination(pressure filters shall be installed shortly)
		Hospital	borewell	3.5	50 OHR		-	
		Shigao	borewell	5	50 GLR		-	
	Dharbandora							
		Gurkhem	borewell	5+3=8	50 GLR	3,994	40	Around 3,200 souls is from Pilliem,Dhadem,Prata pnagar,Occamb are covered under Opa water works.
		Talsai	borewell	3	-		25	
		Tisk	borewell	5	-		40	
		Davcond	borewell	5	-		40	
	Kirlapal-Dabal							
		Cormone	borewell	5	-	6,545	40	
		Dabal	borewell	5	25 GLR		25	
		Codli	borewell	5	-		40	
		Kamarkhand	borewell	5	50 GLR		40	
		Vagona	borewell	5	100 GLR		40	
		Kirlapal	borewell	5	50 GLR		40	
		Sandol	borewell	5	-		40	
		Haluliwada	borewell	7.5	50 GLR		40	pressure filter+chlorination
		Molerimoi	borewell	5	-		40	
	Sanvordem							
		Dhadem	borewell	20	300 GLR	7,407	250	
		Gandhinagar	borewell	5	-		32	
		Guddemol	borewell	5	50 GLR		32	
		Ambeudoc	borewell	5	-		32	
	Others							
		Uguem	tubewell	12.5	-	-	144	
		Valkinim Ⅱ	tubewell	5	-	-	160	
		Valkinim Ⅲ	openwell	3	-	-	40	
		Bhati	openwell	12.5	-	-	150	
		Portem	openwell	5	-	-	60	
		Cumbari(Cumbari,Valshe,Volliana)	tubewell	5	-	-	80	
		Cumbari(Cumbari)	tubewell	5	-	-	80	
		Vaddem Ⅰ	openwell	20	-	-	340	
		Vaddem Ⅱ	tubewell	7.5	-	-	120	
		Natravalim	tubewell	10	-	-	120	
		Nundem	spring		-	-	60	
		Veriem	openwell	5	-	-	80	
		Tadou	spring		-	-	60	
		Mascavorem	openwell	4	-	-	24	
		Curpem Ⅰ	openwell	6	-	-	60	
		Curpem Ⅱ	openwell	6	-	-	60	
		Vichundrem	tubewell	5	-	-	120	
		Rivona	river	15	-	-	150	
		Keneriwada	openwell	6	-	-	60	

Source: PWD Goa - as of May 2006

Table M31.8.2 List of Rural Water Supply Scheme (3/7)

Taluka	Name of Scheme		Source	Pump Capacity (HP)	Capacity of Tank (m^3)	Population covered	Supply Amount (m^3/day)	Remarks
Canacona	Loliem-Polem							
		Polem	sump	5	8 GLR	3,187	13	
		Sheli	sump	5	20 GLR		40	
		Tanshiwada	sump	7.5	20 GLR		40	
		Loliem	sump	5	50 GLR		40	
		Deptamol	borewell	5	50 OHR		30	
		Panskhande	borewell	5	8 GLR		16	
	Poinginim							
		Muthal	borewell	3	20 GLR	2,727	20	
		Sadolxem	sump	5	50 GLR		50	
		Ammona	borewell	5	20 GLR		30	
		Shishewal	sump	5	20 GLR		20	
		Aug to Deptamol	sump	5	50 GLR		40	
		Tirwal	sump	5	20 GLR		-	
	Cotiago							
		Eda	borewell	3	20 GLR	1,845	20	
		Avem	borewell	3	50 GLR		40	
		Badsorem	spring	-	20 GLR		30	
		Aveli	spring	-	-		-	
	Gaondongrem							
		Tudal	borewell	5	8 GLR	2,903	8	
		Bhuper	borewell	5	20 GLR		30	
		Baras	spring	-	10 GLR		25	
		Zitawadi	borewell	5	50 GLR		60	
		Karvem	borewell	5	20 GLR		40	
		Tallem	sump	3	10 GLR		10	
	Shristal							
		Asali	sump	5	20 GLR	3,785	20	
		Gullem	borewell	5	20 GLR		30	
		Chapoli	sump	5	20 GLR		20	
		Aug to Shristal	boosterpump	5	20 GLR		20	
	Agonda							
		Agonda Mudkud	sump	17.5	80 GLR	3,231	-	
		Pervem	sump	7.5	-		100	
		Shelpewal	sump	5	-		-	
		Aug to Agonda	sump	30	350 OHR		700	
	Cola							
		Solyem	sump	5	20	3,515	15	
		Saleri	sump	5	20		30	
		Parikatta	borewell	5	20		30	
		Mollorem	sump	5	20		30	
		Gavai	borewell	5	20		20	
		Nuvem	spring	5	20		20	
		Paremol	stream	5	20		20	
		Popoidanda	stream	5	20		20	
		Cabo-De-Rama	borewellstream	5	50		-	

Source: PWD Goa - as of May 2006

Table M31.8.2 List of Rural Water Supply Scheme (4/7)

Taluka	Name of Scheme	Source	Pump Capacity (HP)	Capacity of Tank (m^3)	Population covered	Supply Amount (m^3/day)	Remarks
Pernem	Tiracol						
	Near Check post	tubewell	-	-	-	Nil	
	Near Fort	tubewell	-	-	-	85 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Keri						
	Talwada	tubewell	-	-	-	345 LPM	
	Gadechawada	tubewell	-	-	-	473 LPM	
	Talwada near Temple	tubewell	-	-	-	333 LPM	
	Harijan wada	tubewell	-	-	-	250 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Paliem						
	Bhandarwada	tubewell	-	-	-	165 LMP	
	Tilvewada	tubewell	-	-	-	107 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Kiranpani	tubewell	-	-	-	250 LPM	
	Arambol						
	Thakurwada	tubewell	-	-	-	105 LPM	
	Parsekarwada	tubewell	-	-	-	75 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Madhalawada	tubewell	-	-	-	105 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Near school	tubewell	-	-	-	88 LPM	
	Near church	tubewell	-	-	-	10 LPM	
	Deulwada	tubewell	-	-	-	-	
	Mandrem						
	Askawada	tubewell	-	-	-	88 LPM	
	Marathwada	tubewell	-	-	-	25 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Madhalamaz	tubewell	-	-	-	88 LPM	
	Salgaonkawada	tubewell	-	-	-	15 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Varchawada	tubewell	-	-	-	25 LPM	
	Mhamalwada	tubewell	-	-	-	25 LPM	
	Askawada	tubewell	-	-	-	88 LPM	
	Naikwaqda near	tubewell	-	-	-	20 LPM	
	Dandoswada near school	tubewell	-	-	-	25 LPM	
	Kmarwada	tubewell	-	-	-	25 LPM	
	Dandoswada Mandrem(2nd)	tubewell	-	-	-	273 LPM	
	Mandrem Madhalamaz(New)	tubewell	-	-	-	65 LPM	
	Gawadewada near temple	tubewell	-	-	-	25 LPM	
	Asvem near temple	tubewell	-	-	-	20 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Madhalamaz near market	tubewell	-	-	-	15 LPM	
	Malarbhat	tubewell	-	-	-	25 LPM	
	Gawadewada	tubewell	-	-	-	25 LPM	
	Junaswada	tubewell	-	-	-	225 LPM	
	Junaswada	tubewell	-	-	-	65 LPM	
	Junaswada	tubewell	-	-	-	Nil	
	Askawada	tubewell	-	-	-	88 LPM	
	Madhalawada	tubewell	-	-	-	15 LPM	

Source: PWD Goa - as of May 2006

Table M31.8.2 List of Rural Water Supply Scheme (5/7)

Taluka	Name of Scheme	Source	Pump Capacity (HP)	Capacity of Tank (m^3)	Population covered	Supply Amount (m^3/day)	Remarks
Pernem	Bidurbag	tubewell	-	-	-	25 LPM	
	Junaswada	tubewell	-	-	-	-	
	Ashvem	tubewell	-	-	-	382 LPM	
	Madhalamaz near existing pump house	tubewell	-	-	-	88 LPM	
	Deulwada	tubewell	-	-	-	65 LPM	
	Corgao						
	Petechawanda	tubewell	-	-	-	-	
	Petechawanda	tubewell	-	-	-	65 LPM	
	Mainwada	tubewell	-	-	-	165 LPM	
	Conadiwada	tubewell	-	-	-	335 LPM	
	Conadiwada	tubewell	-	-	-	276 LPM	
	Deulwada	tubewell	-	-	-	365 LPM	
	Gawadewada	tubewell	-	-	-	65 LPM	
	Bhatwadi	tubewell	-	-	-	65 LPM	
	Bhatwadi	tubewell	-	-	-	65 LPM	
	Bhaidwada	tubewell	-	-	-	Dry	
		tubewell	-	-	-	Dry	
		openwell	-	-	-	-	Scheme is in operation
	Harijianwada	tubewell	-	-	-	65 LPM	
	Morijim						
	Murdiwada	tubewell	-	-	-	15 LPM	
	Newwada	tubewell	-	-	-	65 LPM	
	Deulwadaa near panchayat	tubewell	-	-	-	400 LPM	
		openwell	-	-	-	-	Scheme is abandoned due to salanity
	Warchawada	tubewell	-	-	-	114 LPM	
	Khinwada	tubewell	-	-	-	65 LPM	
	Khin-Kumbarwada	tubewell	-	-	-	65 LPM	
	Newwada	tubewell	-	-	-	65 LPM	
	Madhalawada	tubewell	-	-	-	50 LPM	
	Dabholkarwada	tubewell	-	-	-	-	
	Agarwada-Chopdem						
	Near school Agarwada	tubewell	-	-	-	180 LPM	
	Checkpost Agarwada	tubewell	-	-	-	50 LPM	
	Chopedem	tubewell	-	-	-	85 LPM	
		openwell	-	-	-	-	Scheme is abandoned due to salanity
	Agarwada near school	tubewell	-	-	-	85 LPM	
	Parcem						
	Deulwada	tubewell	-	-	-	180 LPM	
	Deulwada	tubewell	-	-	-	400 LPM	
	Chaweddwada	tubewell	-	-	-	185 LPM	
	Vaidonger near church	tubewell	-	-	-	180 LPM	
	Vaidonger junction	tubewell	-	-	-	65 LPM	
	Madhalawada	tubewell	-	-	-	380 LPM	
	Naiginwada	tubewell	-	-	-	335 LPM	
	Tuem						
	Yuem village	tubewell	-	-	-	330 LPM	
	Zolurem	tubewell	-	-	-	743 LPM	
	Deulwada	tubewell	-	-	-	308 LPM	
		openwell	-	-	-	-	Scheme is in operation

Source: PWD Goa - as of May 2006

Table M31.8.2 List of Rural Water Supply Scheme (6/7)

Taluka	Name of Scheme	Source	Pump Capacity (HP)	Capacity of Tank (m^3)	Population covered	Supply Amount (m^3/day)	Remarks
Pernem	Vimoda						
	Near panchaiyat	tubewell	-	-	-	360 LPM	
	Valpem	tubewell	-	-	-	-	
		openwell	-	-	-	-	Scheme is in operation
	Malpem	tubewell	-	-	-	-	
	Warchawada	tubewell	-	-	-	-	
	Amberem						
	Amberem	tubewell	-	-	-	430 LPM	
	Ugvem						
	Deulwada	tubewell	-	-	-	250 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Mopa						
	Mopa	tubewell	-	-	-	165 LPM	
	Torxem						
	Naikwada	tubewell	-	-	-	160 LPM	
		openwell	-	-	-	-	Scheme is abandoned due to salanity
	Fakirpotto	tubewell	-	-	-	15 LPM	
	Harijanwada	tubewell	-	-	-	380 LPM	
	Patradevi checkpost	tubewell	-	-	-	210 LPM	
	Patradevi	tubewell	-	-	-	640 LPM	
	Varcond						
	Naer school	tubewell	-	-	-	540 LPM	
	Near pump house	tubewell	-	-	-	96 LPM	
	Near Vithaladevi temple	tubewell	-	-	-	-	
		openwell	-	-	-	-	Scheme is in operation
	Near open well of Arjun	tubewell	-	-	-	-	
	Casarvernen						
	Deulwada	tubewell	-	-	-	150 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Purva	tubewell	-	-	-	-	
	Bodgul	tubewell	-	-	-	-	
	Bailpat	tubewell	-	-	-	25 LPM	
	Chandel						
	Chandel village	tubewell	-	-	-	200 LPM	
	Near temple	tubewell	-	-	-	86 LPM	
	Hali Chadel	tubewell	-	-	-	190 LPM	
	Kumarwada Chandel	tubewell	-	-	-	86 LPM	
	Ibrampur Hankhane						
	Hedus	tubewell	-	-	-	34 LM	
	Ibrampur near existing pump house	tubewell	-	-	-	65 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Angadwada HANKHANE	tubewell	-	-	-	25 LPM	
	Near culvert	tubewell	-	-	-	743 LPM	
	Hankhane near pump house	tubewell	-	-	-	743 LPM	
	Harijan wada	tubewell	-	-	-	15 LPM	
	Hassapur						
	In the field	tubewell	-	-	-	273 LPM	

Source: PWD Goa - as of May 2006

Table M31.8.2 List of Rural Water Supply Scheme (7/7)

Taluka	Name of Scheme	Source	Pump Capacity (HP)	Capacity of Tank (m^3)	Population covered	Supply Amount (m^3/day)	Remarks
Pernem	Pernem						
	Mauswada pump house	tubewell	-	-	-	273 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Nanerwada	tubewell	-	-	-	-	
	Surbanwada	tubewell	-	-	-	182 LPM	
	Kotkarwada	tubewell	-	-	-	-	
	Surbanwada II	tubewell	-	-	-	182 LPM	
	Sarmale	tubewell	-	-	-	182 LPM	
	Bhirondem near public tap	tubewell	-	-	-	-	
	Parastem near school	tubewell	-	-	-	25 LPM	
	Parastem bedko	tubewell	-	-	-	182 LPM	
	Harijanwada	tubewell	-	-	-	25 LPM	
	Porascadem						
	Near pump house(1)	tubewell	-	-	-	85 LPM	
		openwell	-	-	-	-	Scheme is in operation
	Near pump house(2)	tubewell	-	-	-	85 LPM	
	Caznem near temple	tubewell	-	-	-	-	
	Naibag (1) near spring	tubewell	-	-	-	85 LPM	
	Naibag near bridge	tubewell	-	-	-	85 LPM	
	Near pump house	tubewell	-	-	-	85 LPM	
	Casanem	tubewell	-	-	-	385 LPM	
	Dhargai						
	Oxelbag	tubewell	-	-	-	-	
		openwell	-	-	-	-	Scheme is in operation
	Macazana	tubewell	-	-	-	25 LPM	
	Ozarim						
	Madkaiwada	openwell	-	-	-	-	Scheme is in operation

Source: PWD Goa - as of May 2006

Appendix M32

Data Concerning Number of Connection and Water Consumption Provided by PWD Goa

Contents for Appendix M32

Appendix M32.1 Data Concerning Number of Connection and Water Consumption Provided by PWD Goa

Taluka: Pernem

Data Source: **Sub-Division office II of Division office XVII, data from Oct 2004 to Jun 2005**

Number of Customers (Number of Connections) Unit: Nos.

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				Total
1 Domestic	5,808	6,305	6,670	6,792	7,029	7,402	7,589	7,832	8,000				
2 Commercial	47	48	51	51	51	52	52	55	55				
3 Government													
4 Industries	2	2	3	3	3	3	3	3	3				
5 Municipality													
6 V. Panchayat													
7 Defense													
8 Temporary Sup.													
9 Inst. Bills													
10 Public Stand Post	1,100	1,100	1,100	1,100	1,100	800	650	520	370				
Total	6,957	7,455	7,824	7,946	8,183	8,257	8,294	8,410	8,428				

Water Consumption Billed per Monthe Unit: m3/month

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				Total
1 Domestic	66,295	60,747	53,669	36,889	42,337	83,929	38,892	44,348	101,987				
2 Commercial	1,954	4,206	284	540	540	1,268	963	751	770				
3 Government	1,953	1,754	1,873	1,473	1,475	1,993	1,812	1,749	2,000				
4 Industries	2,400	899	1,105	1,924	1,924	2,114	1,763	1,710	875				
5 Municipality													
6 V. Panchayat													
7 Defense													
8 Temporary Sup.													
9 Inst. Bills													
10 Public Stand Post	165,000	165,000	165,000	165,000	165,000	120,000	97,500	78,000	55,500				
Total	237,602	232,606	221,931	205,826	211,276	209,304	140,930	126,558	161,132				

PERNEM

Table 4 Year 2004 Total water consumption billed per month Unit:3 (Table 5 + table 6)

Category	Total water Quantity billed per month Unit ;m3												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1) Domestic	66295	60747	53669	38889	42337	83929	38892	44348	101987				
2) Commercial	1954	4206	284	540	540	1268	963	751	770				
3) Government	1953	1754	1873	1473	1475	1993	1812	1749	2000				
4) Industries	2400	899	1105	1924	1924	2114	1763	1710	875				
5) Municipality	---	---	---	---	---	---	---	---	---				
6) V. Panchayat	---	---	---	---	---	---	---	---	---				
7) Defense	---	---	---	---	---	---	---	---	---				
8) Tempory Sup.	---	---	---	---	---	---	---	---	---				
9) Inst. Bills	---	---	---	---	---	---	---	---	---				
10) Public stand pos	165000	165000	165000	165000	165000	120000	97500	78000	55500				
Totals	237602	232606	221931	205826	211276	209304	140930	126558	161132				

Table 1 Year 2004 Number of customers(Number of connections) Unit:Nos (Table 2 + table 3)

Category	Number of customers(Number of connection) Unit :Nos.												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1) Domestic	5808	6305	6570	6792	7029	7402	7589	7832	8000				
2) Commercial	47	48	51	51	51	52	52	55	55				
3) Government	---	---											
4) Industries	2	2	3	3	3	3	3	3	3				
5) Municipality	---	---											
6) V. Panchayat	---	---											
7) Defense	---	---											
8) Tempory Sup.	---	---	---	---	---	---	---	---	---				
9) Inst. Bills	---	---	---	---	---	---	---	---	---				
10) Public stand pos	1100	1100	1100	1100	1100	800	650	520	370				

Taluka: Bardez

Data Source: **Division office XVII, data of June 2005**

Number of Customers (Number of Connections) Unit: Nos. 2005

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				Total
1 Domestic									42,248				
2 Commercial									739				
3 Government									141				
4 Industries									17				
5 Municipality													
6 V. Panchayat													
7 Defense									1				
8 Temporary Sup.									5				
9 Inst. Bills													
10 Public Stand Post													
Total									43,151				

Water Consumption Billed per Monthe Unit: m3/month

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				Total
1 Domestic									848,745				
2 Commercial									48,373				
3 Government									2,903				
4 Industries									14,449				
5 Municipality													
6 V. Panchayat													
7 Defense													
8 Temporary Sup.									103				
9 Inst. Bills													
10 Public Stand Post													
Total									914,573				

WORK DIVISION: XVII(PHE-N), PUBLIC WORKS DEPARTMENT, PORVORIM GOA.

STATEMENT SHOWING DEMAND, COLLECTION AND BALANCE FOR THE MONTH OF JUNE 2005

Name of the Scheme : Assonora Water Supply Scheme.

SUB DIVISION: III, MAPUSA
SUB DIVISION: V, PORVORIM.

Quantity of water pumped: 1560000 m3

Sr.No.	Category	Number of Consumers	Opening balance	Units billed	Water charges	Meter Rent	Sundry charges (Inst. Bill)	D.P.C.	Total	Amount collected including arrears	Closing balance	Remarks
I	2	3	4	5	6	7	8	9	10	11	12	13
I	1) Domestic	42248	8626429	848745	2537062.00	344663.00			2881725.00	3044099.00	8464055.00	
	2) Government	141	92491	2903	12567.00	606.00			13173.00	12518.00	93146.00	
	3) Municipality											
	4) Village Panchayat											
	5) Defence	1	155045							155045.00		
II	6) Commercial	739	4366079	48373	1324377.00	5734.00			1330111.00	665320.00	5030870.00	
	7) Temporary Supply	5	105918	103	3090.00	34.00			3124.00	7347.00	101695.00	
III	8) Industrial	17	1471567	14449	288458.00	545.00			289003.00	1699154.00	61416.00	
IV	9) Institutional											
	10) Others											
	Total	**43151**	**14817529**	**914573**	**4165554.00**	**351582.00**		**0.00**	**4517136.00**	**5583483.00**	**13751182.00**	

M32 - 4

Taluka: Tiswadi

Data Source: **Sub Division office I of Division office III, data of average in 2004**

Number of Customers (Number of Connections) Unit: Nos. 2004

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				Total
1 Domestic			27,228										
2 Commercial			575										
3 Government			270										
4 Industries			12										
5 Municipality			29										
6 V. Panchayat													
7 Defense			14										
8 Temporary Sup.													
9 Inst. Bills													
10 Public Stand Post													
Total			28,128										

Water Consumption Billed per Monthe Unit: m3/month

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				Total
1 Domestic			599,368										
2 Commercial			34,908										
3 Government			4,050										
4 Industries			42,194										
5 Municipality			290										
6 V. Panchayat													
7 Defense			28,389										
8 Temporary Sup.													
9 Inst. Bills													
10 Public Stand Post													
Total			709,199										

No. PWD/PHE-N/SD I/WD-III/F39/2005-06/ 796

Government of Goa,
Office of the Assistant Engineer,
Sub. Div. I, Div. III, (PHE-N),
Public Works Department,
St.– Inez, Panaji – Goa.

Dated :- 15/07/2005.

To,
JICA,
C/o SIDCL, Ishari Building,
Panaji – Goa.

Sub :- Details on water supply.

Ref :- AWSSG – 0011 dated 20/6/2005.

Sir,

Please find enclosed herewith the details of consumers, quantity of water supplied and billed etc., in response to your letter cited above, forwarded to this office under the cover of letter No. PWD/CE-I/F-1/19/05-06/74 dated 23/6/2005.

Yours faithfully,

Assistant Engineer

Copy to The Executive Engineer, W. Div. III , P.W.D. Panaji, Goa.

Data on Customers / Water Consumption / Billing of Water Supply System

Division Number :- III Division Name :- Public Works Department

Sub-Division Number :- I Sub-Division Name :- _____

Name of Officer filled in this form :- _____ Tiswadi Panaji

Tel. Number _____

Name of Service Area under jurisdiction of this Sub-Division

	Taluka	City	Town	Village
1	Tiswadi	Panaji		
2			Goa Velha	
3			Bambolim	
4			Calapur	
5			Chimbel	
6				Capao
7				Navelim
8				Goltim
9				Malar
10				Maroa
11				Corlim
12				Ella
13				Baiguinim
14				Carambolim
15				Azossim
16				Mandur
17				Batim
18				Siridao
19				Neura-O-Pequeno
20				Neura-O-Grande
21				Mercurim
22				Morambi-O-Grande
23				Morambi-O-Pequeno
24				Cujira
25				Murda
26				
27				
28				
29				
30				

Table - 1 Year 2004 Number of Customers (Number of Connections) Unit : Nos. (Table - 2 + Table - 3)

Category	Number of Customers (Number of Connections) Unit : Nos.												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1 Domestic												27228	
2 Commercial												575	
3 Government												270	
4 Industries												12	
5 Municipality												29	
6 V. Panchayat													
7 Defense												14	
8 Temporary Sup.													
9 Inst Bills.													
10 Public Stand Post													
Total												28128	

Table - 2 Year 2004 Number of Customers (Number of Connections) with GOOD WORKING WATER METERS Unit Nos.

Category	Number of Customers (Number of Connections) with GOOD WORKING METERS Unit : Nos.												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1 Domestic												23336	
2 Commercial												505	
3 Government												192	
4 Industries												11	
5 Municipality													
6 V. Panchayat													
7 Defense												2	
8 Temporary Sup.													
9 Inst Bills.													
10 Public Stand Post													
Total												24046	

Table - 3 Year 2004 Number of Customers (Number of Connections) with MALFUNCTIONED/BROKEN WATER METERS Unit Nos.

Category	Number of Customers (Number of Connections) withMALFUNCTIONED /BROKEN METERS Unit : Nos.												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1 Domestic												3892	
2 Commercial												70	
3 Government												78	
4 Industries												1	
5 Municipality												29	
6 V. Panchayat													
7 Defense												12	
8 Temporary Sup.													
9 Inst Bills.													
10 Public Stand Post													
Total												4082	

Tiswadi Panaji

Table - 4 Year 2004 Total Water Consumption Billed per Month Unit : m3 (Table - 5 + Table - 6)

Category	Total Water Quantity Billed per Month Unit : m3												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1 Domestic												599368	
2 Commercial												34908	
3 Government												4050	
4 Industries												42194	
5 Municipality												290	
6 V. Panchayat													
7 Defense												28389	
8 Temporary Sup.													
9 Inst Bills.													
10 Public Stand Post													
Total												709199	

Table - 5 Year 2004 Water Consumption Billed Based on Meter Reading (by Good Meter) Unit : m3

Category	Water Consumption Billed Based on Meter Reading (by Good Meter) Unit : m3												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1 Domestic												540988	
2 Commercial												33508	
3 Government												2880	
4 Industries												41944	
5 Municipality													
6 V. Panchayat													
7 Defense												28149	
8 Temporary Sup.													
9 Inst Bills.													
10 Public Stand Post													
Total												647469	

Table - 6 Year 2004 Water Consumption Billed Based on Estimation (bcause of malfunctioned/ broken meter) Unit : m3

Category	Water Consumption Billed Based on Estimation (bcause of malfunctioned/ broken meter) Unit : m3												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1 Domestic												58380	
2 Commercial												1400	
3 Government												1170	
4 Industries												250	
5 Municipality												290	
6 V. panchayat													
7 Defense												240	
8 Temporary Sup													
9 Inst Bills.													
10 Public Stand Post													
Total												61730	

Taluka: Bicholim

Data Source: **Division office XVII , data of June 2005**

Number of Customers (Number of Connections) Unit: Nos. 2005

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				Total
1 Domestic									11,223				
2 Commercial									270				
3 Government									28				
4 Industries									9				
5 Municipality									33				
6 V. Panchayat									15				
7 Defense													
8 Temporary Sup.													
9 Inst. Bills									65				
10 Public Stand Post													
Total									11,643				

Water Consumption Billed per Monthe Unit: m3/month

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				Total
1 Domestic									291,325				
2 Commercial									10,998				
3 Government									6,504				
4 Industries									6,955				
5 Municipality									2,455				
6 V. Panchayat									604				
7 Defense													
8 Temporary Sup.													
9 Inst. Bills									4,684				
10 Public Stand Post													
Total									323,525				

WORK DIVISION: XVII(PHE-N), PUBLIC WORKS DEPARTMENT, PORVORIM GOA.

STATEMENT SHOWING DEMAND, COLLECTION AND BALANCE FOR THE MONTH OF JUNE 2005

Name of the Scheme : Podocem Water Supply Scheme, Sanquelim. SUB DIVISION: I, BICHOLIM

Quantity of water pumped: 405000m3

Sr.No.	Category	Number of Consumers	Opening balance	Unit billed	Water charges	Meter Rent	Sundry charges (Inst. Bill)	D.P.C.	Total	Amount collected including arrears	Closing balance	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13
I	1) Domestic	11223	983126	291325	955600.00	108016.00	43880.00		1107496.00	1079516.00	1011106.00	
	2) Government	28	123287	6504	31259.00	290.00	580.00		32129.00	8151.00	147265.00	
	3) Muncipality	33		2455	9648.00	321.00			9969.00	9969.00		
	4) Village Panchayat	15	6367	604	2271.00	178.00			2449.00	240.00	8576.00	
	5) Defence								0.00			
II	6) Commercial	270	743614	10998	296530.00	2664.00	4460.00		303654.00	221824.00	825444.00	
	7) Temporary Supply			0					0.00			
III	8) Industrial	9	298560	6955	139100.00	174.00			139274.00	131908.00	305926.00	
IV	9) Institutional	65		4684	22414.00	692.00			23106.00	20817.00		
	10) Others								0.00			
	Total	**11643**	**2154954**	**323525**	**1456822.00**	**112335.00**	**48920.00**		**1618077.00**	**1472425.00**	**2298317.00**	

Taluka: Satari

Data Source: **Sub-Division office II of Division office XVII, data from March 2006 to April 2006**

Number of Customers (Number of Connections) Unit: Nos.

Category	Oct	Nov	Dec	Jan	Feb	Mar 2006	Apr 2006	May	Jun				Total
1 Domestic						6,068	6,111						
2 Commercial						72	72						
3 Government						125	126						
4 Industries						13	13						
5 Municipality						5	5						
6 V. Panchayat						19	19						
7 Defense													
8 Temporary Sup.													
9 Inst. Bills													
10 Public Stand Post						517	517						
Total						6,819	6,863						

Water Consumption Billed per Monthe Unit: m3/month

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				Total
1 Domestic						106,894	115,589						
2 Commercial						1,793	1,737						
3 Government						5,159	6,851						
4 Industries						2,821	3,073						
5 Municipality						199	219						
6 V. Panchayat						293	361						
7 Defense													
8 Temporary Sup.													
9 Inst. Bills													
10 Public Stand Post						80,135	80,135						
Total						197,294	207,965						

STATEMENT SHOWING DEMAND COLLECTION AND BALANCE FOR THE MONTH OF : APRIL-06

Nmae of Villages	Total Water Distributed	No. of Consumers Category wise	Population Covered	No. of Public taps PSP	Qty. supplied through PSP	Qty. of water billed	Total NRWm^3 2-(6+7)	NRW %	UFW 2-(6=7)	LPCD per Liters/Person day	Faulty meters category wise	No. of meters replaced category wise	No. of disconnections category wise	Deamnd (billing) Category wise in Rs.	Opening balance category wise in Rs.	Amount collected category wise in Rs.	Closing balance category wise in Rs.	Name of meter reader for concerne Zone
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
All Villages of Pernem Taluak	223200	DO-6111	30555			115589	15235	6.83	15235	122	608	8	6	564747	763522	509715	818554	
	31000	GT-41				3252						1		63427	48349	39993	71783	
		MC-5				219								3776	1228	196	4808	
		VP-19				361								2519	50	849	1720	
		COM-72				1737								42225	81667	24379	99513	
		IND-13				3073								68396	2816	67579	3633	
		INST. 85				3599					18	1		28650	-162	4979	23509	
				517	80135	...		18.18						100680	381090	—	481770	
	223200	6346	30555	517	80135	127830	15235	6.83	15235	122	626	9	6	874420	1278560	647690	1505290	

25 u 200

Col. 19 Name of the Meter Reader for concerned Zone

1) Gurudas F. Gawas	Valpoi/Sawardem
2) Datta D. Naik	Valpoi/Morlem
3) Rajendra Gaonkar	Honda/Pissurlem
4) Tulshidas S. Gaonkar	Mauxi/Bhioronde
5) Gopal G. Salelkar	Thane/Nagargao
6) Dattaram Gaonkar	Khotode/Guleli
7) Subhash F. Gawas	Parye/Kerim

In this table, name of Taluka is shown as "Pernem", but it is mistype and this talbe is for "Satari" Taluka.

STATEMENT SHOWING DEMAND COLLECTION AND BALANCE FOR THE MONTH OF : MARCH-06

Nmae of Villages	Total Water Distribution	No. of Consumers Category wise	Population Covered	No. of Public taps PSP	Qty. supplied through PSP	Qty. of water billed	Total NRWm^3 2-(6+7)	NRW %	UFW 2-(6=7)	LPCD per Liters/Person day	Faulty meters category wise	No. of meters replaced category wise	No. of disconnections category wise	Deamnd (billing) Category wise in Rs.	Opening balance category wise in Rs.	Amount collected category wise in Rs.	Closing balance category wise in Rs.	Name of meter reader for concerne Zone
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
All Villages of Pernem Taluak	223200	DO-6068	30340			106894	25906	11.60	25906	114	623	15	1	535274	766797	538549	763522	
		GT-40				1699					1	1		11729	51119	14499	48349	
		MC-5				199								3023	1086	2881	1228	
		VP-19				293								1819	....	1769	50	
		COM-72				1793							1	43439	82491	44263	81667	
		IND-13				2821								62936	7405	67525	2816	
		INST. 85				3460								21471	24400	46033	-162	
				517	80135	...					19	1		105461	275629	....	381090	
	223200	6302	30340	517	80135	117159	25906	11.60	25906	114	643	17	2	785152	1208927	715519	1278560	

Col. 19 Name of the Meter Reader for concerned Zone

1) Gurudas F. Gawas	Valpoi
2) Datta D. Naik	Valpoi/Morlem
3) Rajendra Gaonkar	Honda/Pissurlem
4) Tulshidas S. Gaonkar	Mauxi/Bhioronde
5) Gopal G. Salelkar	Thane/Nagargao
6) Dattaram Gaonkar	Sawardem/Khotode/Guleli
7) Subhash F. Gawas	Parye/Kerim

In this table, name of Taluka is shown as "Pernem", but it is mistype and this talbe is for "Satari" Taluka.

Taluka: Ponda

Data Source: **Division office III, data of July 2005**

Number of Customers (Number of Connections) Unit: Nos. **2005**

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul			Total
1 Domestic										16471			
2 Commercial										344			
3 Government										110			
4 Industries										59			
5 Municipality										6			
6 V. Panchayat													
7 Defense													
8 Temporary Sup.													
9 Inst. Bills													
10 Public Stand Post													
Total			0							16990			

Water Consumption Billed per Monthe Unit: m3/month

Category	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul			Total
1 Domestic										471097			
2 Commercial										11163			
3 Government										10440			
4 Industries										70430			
5 Municipality										71			
6 V. Panchayat													
7 Defense													
8 Temporary Sup.													
9 Inst. Bills													
10 Public Stand Post													
Total			0							563201			

Division III Sub-Division IV

STATEMENT SHOWING DEMAND, COLLECTION AND BALANCE FOR THE MONTH OF July 2005

Name of the Scheme (e.g.) QPA Water Works

Quantity of Water Pumped: M3

Ponda Only

Sr. No.	Category	Number of Consumers	Opening Balance	Units Billed & Amount	Meter Rent	Sundry Charges	D.P.C.	Total	Amount Collected including arrears	Closing Balance	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
I	1) Domestic	16471	-	m3 471097 179346 Rs. 1524270/-	-	-	-	-	866985/-	4357526/-	
	2) Government	77	-	m3 4709 997/- Rs. 20686/-					4640/-	22726/-	
	3) Municipality	6	-	m3 71 Rs. 211/-	-	-	-	-	-	747/-	
	4) Village Panchayat	-	-	-	-	-	-	-	-	-	
	5) Defence	-	-	-	-	-	-	-	-	-	
II	6) Commercial	344	-	m3 11163 3765/- Rs. 256060/-		-			144503/-	592263/-	
	7) Temporary Supply	-	-	-	-	-	-	-	-	-	
III	8) Industries	59		m3 70430 2406/- Rs. 1576100/-		-	-	-	-		
IV	9) Institutions	33		m3 5751 623/- Rs. 23290/-					1649401/- 22567/-	15756/- 1503534/-	
V	10) Others Installation	-	-	-	-	-	-	-	11754/-	--	
	Total	16987	-	m3 563291 167140 Rs. 3400617/-		-	-	-	2729940/-	6498549/-	

ASSISTANT ENGINEER,
SDVP, WDIII (PHE) PWD,
BAAG, PONDA-GOA.

Taluka: Mormugao

Data Source: **Private Firm (Megasoft), data of 2004**

Number of Customers (Number of Connections) Unit: Nos.

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	14,730	14,788	14,858	14,982	15,147	15,224	15,407	15,330	15,536	15,668	15,761	15,887	
2 Commercial	255	262	264	266	268	266	266	262	263	264	263	261	
3 Government	125	124	124	125	126	128	128	128	132	133	133	134	
4 Industries	320	314	310	307	304	301	299	298	297	298	293	298	
5 Municipality	0	0	0	0	0	0	0	0	0	2	2	5	
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	
7 Defense	12	12	12	12	12	12	12	12	12	12	12	12	
8 Temporary Sup.	20	22	24	24	19	20	19	18	16	15	14	14	
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	
10 Public Stand Post	135	135	135	135	135	135	135	135	135	134	134	134	
Total	15,597	15,657	15,727	15,851	16,011	16,086	16,266	16,183	16,391	16,526	16,612	16,745	

Water Consumption Billed per Monthe Unit: m3/month

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	0	678,306	276,283	974,418	454,719	399,618	356,908	165,588	440,659	369,920	538,927	383,270	5,038,616
2 Commercial	0	16,559	3,084	22,251	6,886	9,509	6,770	5,859	7,004	8,565	9,401	4,537	100,425
3 Government	0	28,219	19,256	39,781	18,612	20,178	19,127	8,990	21,460	17,796	29,479	21,667	244,565
4 Industries	0	72,012	19,768	85,477	29,539	45,149	10,548	31,304	6,701	56,082	23,964	47,383	427,927
5 Municipality	0	0	0	0	0	0	0	0	0	45	0	3,881	3,926
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Defense	0	16,843	6,639	23,116	5,819	16,926	10,954	7,429	15,565	4,624	3,746	19,105	130,766
8 Temporary Sup.	0	3,416	21,638	36,640	1,567	26,743	815	1,379	26,749	1,068	42,513	412	162,940
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Public Stand Post	0	4,797	737	6,086	2,393	2,306	1,466	1,262	1,464	2,945	2,305	2,734	28,495
Total	0	820,152	347,405	1,187,769	519,535	520,429	406,588	221,811	519,602	461,045	650,335	482,989	6,137,660

Taluka: Salcete

Data Source: **Private Firm (Megasoft), data of 2004**

Number of Customers (Number of Connections) Unit: Nos.

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	41,640	41,845	41,988	42,150	42,266	42,326	42,362	42,620	42,893	43,183	43,419	43,409	
2 Commercial	315	319	327	331	331	335	335	337	342	346	346	349	
3 Government	313	319	323	335	341	366	366	397	403	408	409	481	
4 Industries	502	508	510	514	516	516	518	518	525	531	541	544	
5 Municipality	2	2	2	2	2	2	2	2	2	3	3	3	
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	
7 Defense	4	3	3	3	2	3	2	3	2	5	3	3	
8 Temporary Sup.	84	86	89	92	89	84	86	88	88	87	81	85	
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	
10 Public Stand Post	83	83	83	83	83	83	83	83	86	86	86	86	
Total	42,943	43,165	43,325	43,510	43,630	43,715	43,754	44,048	44,341	44,649	44,888	44,960	

Water Consumption Billed per Monthe Unit: m3/month

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	1,005,207	1,314,746	1,528,709	1,407,886	1,189,174	881,517	900,190	918,858	976,368	968,020	816,275	437,238	12,344,188
2 Commercial	69,513	84,608	79,450	74,918	70,722	70,720	54,231	69,658	68,485	66,153	63,479	65,857	837,794
3 Government	50,650	78,513	64,393	86,617	67,236	66,140	44,404	68,229	78,316	70,486	30,758	42,382	748,124
4 Industries	62,862	90,023	76,034	68,730	71,149	63,821	48,669	59,000	71,854	70,664	64,474	56,429	803,709
5 Municipality	66	0	59	37	0	36	0	48	0	305	75	0	626
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Defense	151,846	1,860	139,440	76,860	990	73,204	870	97,434	870	133,508	960	870	678,712
8 Temporary Sup.	7,727	12,837	9,423	11,864	11,477	5,988	7,730	9,174	7,269	7,563	4,496	6,007	101,555
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Public Stand Post	962	2,299	1,687	2,319	1,767	1,754	804	1,967	2,245	1,241	813	616	18,474
Total	1,348,833	1,584,886	1,899,195	1,729,231	1,412,515	1,163,180	1,056,898	1,224,368	1,205,407	1,317,940	981,330	609,399	15,533,182

Taluka: Quepem

Data Source: **Private Firm (Megasoft), data of 2004**

Number of Customers (Number of Connections) Unit: Nos.

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	9,669	9,932	10,078	10,162	10,169	10,225	9,805	9,845	10,332	10,420	10,496	10,542	
2 Commercial	93	95	97	99	102	102	102	102	103	106	107	108	
3 Government	73	73	73	73	73	74	68	68	75	74	74	74	
4 Industries	78	76	75	76	76	77	76	75	76	77	78	78	
5 Municipality	0	0	0	0	0	0	0	0	0	0	0	0	
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	
7 Defense	0	0	0	0	0	0	0	0	0	0	0	0	
8 Temporary Sup.	11	10	12	12	12	12	14	11	11	11	14	12	
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	
10 Public Stand Post	224	224	224	224	224	224	224	224	224	224	224	224	
Total	10,148	10,410	10,559	10,646	10,656	10,714	10,289	10,325	10,821	10,912	10,993	11,038	

Water Consumption Billed per Monthe Unit: m3/month

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	179,536	288,712	158,836	226,230	233,108	348,456	167,022	217,483	126,032	181,436	226,645	148,470	2,501,966
2 Commercial	2,687	2,465	2,210	2,198	2,974	4,486	2,194	3,089	1,149	3,418	3,299	1,070	31,239
3 Government	10,526	8,078	8,081	1,449	8,065	8,677	7,553	9,425	1,614	10,689	9,178	854	84,189
4 Industries	2,133	10,386	1,706	12,275	1,850	9,529	1,247	8,592	297	1,720	3,848	6,690	60,273
5 Municipality	0	0	0	0	0	0	0	0	0	0	0	0	0
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Defense	0	0	0	0	0	0	0	0	0	0	0	0	0
8 Temporary Sup.	748	658	1,319	448	1,249	1,485	751	654	0	914	743	0	8,969
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Public Stand Post	828	882	4,563	0	5,847	1,079	4,446	897	0	4,577	843	4,723	28,685
Total	196,458	311,181	176,715	242,600	253,093	373,712	183,213	240,140	129,092	202,754	244,556	161,807	2,715,321

Taluka: Sanguem

Data Source: **Private Firm (Megasoft), data of 2004**

Number of Customers (Number of Connections) Unit: Nos.

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	2,424	2,427	2,442	2,449	2,445	2,475	2,480	2,490	2,493	2,577	2,578	2,588	
2 Commercial	18	17	17	17	17	17	16	17	17	17	17	17	
3 Government	13	13	14	14	14	14	14	14	14	14	14	16	
4 Industries	2	2	2	2	2	4	4	4	4	6	6	6	
5 Municipality	1	1	1	1	1	1	1	1	1	1	1	1	
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	
7 Defense	0	0	0	0	0	0	0	0	0	0	0	0	
8 Temporary Sup.	0	1	2	1	4	4	4	3	3	4	4	3	
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	
10 Public Stand Post	49	49	49	49	49	49	49	49	49	49	49	49	
Total	2,507	2,510	2,527	2,533	2,532	2,564	2,568	2,578	2,581	2,668	2,669	2,680	

Water Consumption Billed per Monthe Unit: m3/month

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	40,303	63,484	46,606	53,208	19,184	82,923	20,682	77,738	8,456	101,126	5,868	89,916	609,494
2 Commercial	193	709	350	764	20	692	81	839	97	988	21	847	5,601
3 Government	226	565	404	534	231	605	169	649	0	1,027	0	1,926	6,336
4 Industries	0	821	0	301	0	415	0	353	323	833	0	215	3,261
5 Municipality	23	0	31	0	0	141	0	107	0	39	0	31	372
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Defense	0	0	0	0	0	0	0	0	0	0	0	0	0
8 Temporary Sup.	0	28	87	0	225	111	491	0	0	582	0	500	2,024
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Public Stand Post	969	384	1,015	262	1,311	569	1,504	565	0	1,597	0	1,364	9,540
Total	41,714	65,991	48,493	55,069	20,971	85,456	22,927	80,251	8,876	106,192	5,889	94,799	636,628

Taluka: Canacona

Data Source: **Private Firm (Megasoft), data of 2004**

Number of Customers (Number of Connections) Unit: Nos.

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	3,020	3,038	3,081	3,110	3,139	3,178	3,176	3,181	3,192	3,207	3,230	3,246	
2 Commercial	92	94	93	93	92	92	93	94	93	91	91	90	
3 Government	48	48	48	53	53	55	55	57	57	57	56	56	
4 Industries	12	13	12	12	12	11	11	11	12	15	15	16	
5 Municipality	0	0	0	0	0	0	0	0	0	0	0	0	
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	
7 Defense	0	0	0	0	0	0	0	0	0	0	0	0	
8 Temporary Sup.	5	5	5	3	3	3	3	3	3	3	3	3	
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	
10 Public Stand Post	18	18	18	18	18	18	18	18	18	18	18	20	
Total	3,195	3,216	3,257	3,289	3,317	3,357	3,356	3,364	3,375	3,391	3,413	3,431	

Water Consumption Billed per Monthe Unit: m3/month

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1 Domestic	13,369	102,833	37,276	112,197	35,229	105,412	49,193	86,231	35,671	75,497	36,774	80,121	769,803
2 Commercial	330	4,896	501	4,852	474	4,425	552	3,810	461	3,211	509	3,539	27,560
3 Government	50	3,741	74	4,182	46	4,405	387	3,574	216	4,731	173	4,421	26,000
4 Industries	0	1,112	0	1,342	0	960	0	852	204	1,230	55	1,782	7,537
5 Municipality	0	0	0	0	0	0	0	0	0	0	0	0	0
6 V. Panchayat	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Defense	0	0	0	0	0	0	0	0	0	0	0	0	0
8 Temporary Sup.	0	931	0	1,265	0	303	0	310	0	300	0	265	3,374
9 Inst. Bills	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Public Stand Post	0	6,242	0	6,233	0	6,257	0	6,478	0	6,485	0	6,065	37,760
Total	13,749	119,755	37,851	130,071	35,749	121,762	50,132	101,255	36,552	91,454	37,511	96,193	872,034